SCIENTIFIC AMERICAN

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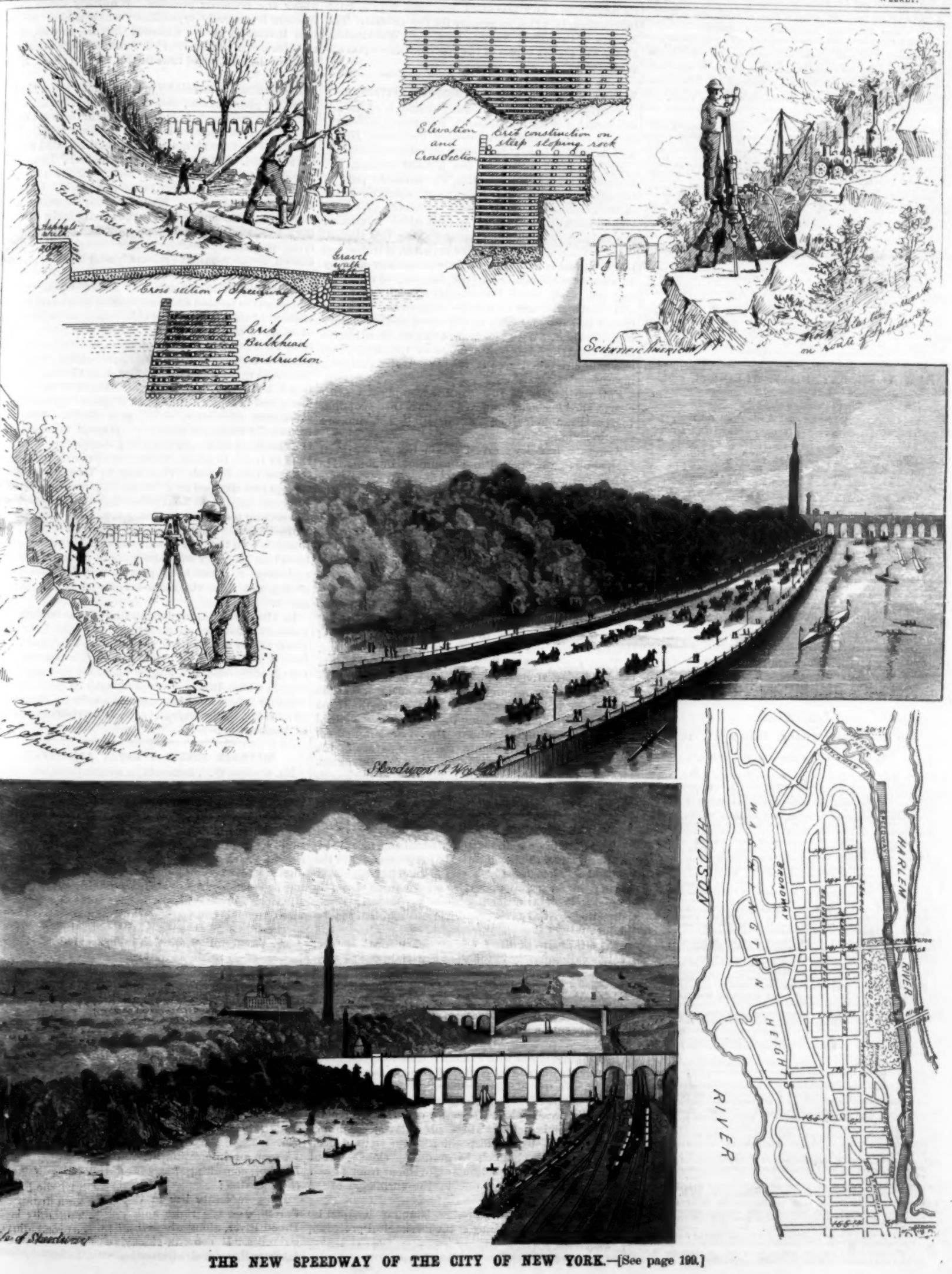

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MAGAZINE RIFLES FOR THE U. S. NAVY.

The Secretary of the Navy of the United States has advertised for inventions of magazine rifles for the naval service. His notice to inventors will be found in our advertising columns. On August 1, 1894, a naval board will convene at the Naval Torpedo Station, Newport, R. I., to test rifles for the service. The inventors of the country are invited to submit their inventions to the board to be tested for adoption in the navy and marine corps. The ammunition and caliber are already decided on; the model for the guns is yet to be accepted. We trust that the United States will produce an acceptable arm, and that it will not be necessary for our government to look to other countries for its navy rifle. Our inventors now have four months before them in which to prepare for the contest. The Bureau of Ordnance, Navy Department, Washington, D. C., will supply copies of the specifications upon application.

RECENT WORK AT THE SMITHSONIAN INSTITUTION.*

Notwithstanding the increasing demands of the administration of the Smithsonian, the present secretary, like his distinguished predecessors Professors Henry and Baird, has been able to carry on valuable research.

By a method which he has himself devised, Mr. Langley has been investigating the invisible part of the solar spectrum. The instrument which he uses is called a bolometer. It is a strip of metal $\frac{1}{1000}$ of an inch in thickness and $\frac{1}{100}$ of an inch wide. A current of electricity is constantly passed along this thread. "When the spectrum, visible or invisible, is thrown on it, the thread is warmed and the current decreased by an amount corresponding to the intensity of the effect received, while novel instruments specially mounted and constructed are in electric connection with the thread and automatically record every minute change in this current. With late improvements, these instruments are so delicate that change of temperature of one millionth of a degree is readily detected and even measured."

Full particulars of the work accomplished with charts, showing some hundreds of lines corresponding to the "Fraunhofer lines" of the visible spectrum, are soon to be published.

Secretary Langley's investigation has so far been carried on in a temporary and unsuitable building. He hopes that Congress may soon see fit to select a site for a small but properly constructed Astrophysical Observatory, for the construction of which $10,000 has already been placed in his hands by private donors interested in the research.

The Bureau of Ethnology, under the direction of Major Powell and Dr. Cyrus Thomas, has been for five years making special study of the mounds in the Mississippi Valley. Their elaborate report, soon to be published, will show that the evidence they have found leads the investigators to the belief that the mound builders were the progenitors of the modern Indians.

From the Hodgkins Prize Fund given to the Smithsonian by Mr. Hodgkins, of Setauket, L. I., for the encouragement of research upon the nature of atmospheric air and its properties, a grant of $1,000 has been made to Dr. J. S. Billings, U. S. A., Army Medical Museum, Washington, and to Dr. Weir Mitchell, of Philadelphia, for investigation into the nature of the organic substances exhaled from the lungs by human beings, with reference to the application of the results to the solution of the difficult problem of proper ventilation.

THE FLOW OF SOLIDS UNDER PRESSURE.

The form of no solid matter or metal can be said to be fixed, under the possibilities of pressure equal to the flow of its atoms toward a readjustment of an equilibrium necessary to maintain a permanent form, by equalizing or transferring pressures from a single direction to the multiple directions required for stability.

The measure of the force necessary for the flow of solids varies greatly in different materials, due to varying molecular adhesion. The hardest materials known are no doubt subject to molecular change of form under pressure, but as we can only use the hardest and most resisting material for producing pressure, there is an apparent limit at which we can prove the flow of solids.

All nature teems with evidence that long-continued pressure bends and folds the solid rocks forming the stratified crust of the earth into the most fantastic forms, in the effort to conform to a condition of equilibrium in pressure. The presence of intense force by compression is manifest at the present time in mines and quarries, by the disposition of the walls of deep mines and rock channels to gradually close without fracture, by a slow molecular movement from a great and constant pressure due to the shrinkage of the earth's crust.

The flow of metals by pressure is well understood by those familiar with many of the mechanical processes, and some metals seem to flow like water under pressure.

Under a pressure of from 6,000 to 8,000 pounds per square inch, the movement of the warm lead from a pipe press is a novel sight. At 10,000 to 12,000 it issues at ordinary shop temperature. Block tin issues from the same press at from 16,000 to 20,000 pounds per square inch from warm to cold.

It has been shown that, in punching very thick iron nuts cold, the punched sprue under a slow movement of the punch was a little more than one-third the volume of the hole—evidence that two-thirds had flowed into the body of the nut. The reduction of area in testing metals is a measure of their flowing qualities under the requisite pressure. If quickly done, their fracture is generally crystalline; while a slow reduction invariably shows a fibrous fracture, as well, also, an increase in the amount of reduction, showing the value of the relation of time in the flow of solid matter.

The welding of metals by pressure alone is a most interesting phenomenon, and as far as experiments have gone gives evidence of plasticity even in the most crystalline and brittle metals. The pressure required to weld the powdered mass into a solid is stated as follows: Lead, 13 tons to the square inch, becoming liquid at 33 tons per square inch. Tin, 19 tons per square inch, and at 47 tons becomes a liquid. Copper, 33 tons per square inch. Zinc, antimony, bismuth, and aluminum, at about 38 tons to the square inch; becoming a solid structure from their powders. Their liquefying pressures probably cannot be experimentally known, as the required pressure is near the limit of the strongest metals to withstand.

Under the ordinary use and strain upon metals where severe tension and compression are required, the element of time is one of the chief exponents in the flow of solids by molecular change of form and place. This is well illustrated in the set of bolts, beams, stays, and struts in structures with permanent strains, wherever the strain approaches to near the elastic limit. Vibration is a vital factor in the readjustment of molecular forms and becomes a time limit of great importance in suspension structures, axles, and shafts. What is termed the fatigue of metals is a general expression of the changing molecular condition from strain or vibration, or both; in which experiments have shown a partial recovery by rest. This may be true in regard to springs and strained or vibrating members of a structure, car axles, and heavy shafting; but as applied to the cutting tools of everyday use we have only a very limited faith. That improved qualities have been found in iron that has lain dormant many years and in tools that are rusty with age may be patent to many, and seems to have been proved in a few cases; but should not from this alone become an acknowledged axiom.

In the view and understanding of the tendency to molecular flow in all structural material toward a weaker form or condition, especially in tensional members, it is a most important consideration that the factor of safety should be largely increased in every structure in which life and property may be jeopardized, whether it be a machine, a boiler, a vehicle, a building, or a bridge. Absolute safety should be the prime axiom of construction.

BILTMORE FOREST—A GREAT ARBORETUM.

Mr. George W. Vanderbilt, a wealthy and enterprising citizen of New York, purchased some time ago a large tract of forest land near Asheville, N. C., with the design of converting it into a grand arboretum, which should not only contain every tree species that could be grown in the latitude, but in its management should stand as an example of scientific forestry conducted under favorable auspices. Substantial progress has been made already in this laudable endeavor, and Biltmore Forest is likely, in the course of a few years more, to take the highest rank among enterprises of its class.

Mr. Vanderbilt is entitled to great credit for his selection of so noble an object on which to devote his means and attention. We need not dwell upon the great importance to the country of the inauguration of a great forestry school, as this might be termed, where the best methods of preserving, cultivating, improving, and propagating forests is being practically exemplified. In all parts of the land the noblest forests may be seen going to ruin, and little or no systematic effort has ever been made to protect or preserve them. The results are highly disastrous. Our streams prematurely dry up, the soil is denuded, and extensive regions, which with intelligent forest care might be made valuable, are impoverished and rendered worthless.

From an interesting little brochure by Mr. Gifford Pinchot, consulting forester of the estate, we gather the following:

Biltmore estate lies in the western part of North Carolina, on the right and left banks of the French Broad River, along which it stretches for a distance of six miles. It consists chiefly of broken, hilly land, fairly well watered, alternating with the broad alluvial

* Report of S. P. Langley, Secretary of the Smithsonian Institution, for the year ending June 30, 1893, to the Board of Regents.

bottoms. The summits of the hills reach an average altitude of about 2,300 feet. The total area is 7,282 acres, or rather more than eleven square miles.

A little more than one-half of the whole surface of the estate is woodland, and constitutes Biltmore Forest. The changing slopes, the many kinds of trees, and the great variety in its density, size, and condition, are marked features of the forest. It derives an additional interest from the fact that it is the first piece of woodland in the United States to be subjected to a regular system of management, the prime object of which is to pay the owner while improving the forest.

Biltmore Forest is composed for the most part of deciduous trees. Of these the white oak is in all respects first. Second to it numerically, but of inferior quality, are the black, the scarlet, and the Spanish oaks, in the order named. These are followed by the short-leaf pine and the chestnut, and these again by the hickory, chestnut oak, black gum, maple, tulip tree, and various others.

At the time when forest management was begun on the estate the condition of a large part of the forest was deplorable in the extreme. The people were in the habit of cutting all trees which could be used or sold as fuel, fencing, or saw logs. They turned their cattle into the forest, and often burned over their woodlands for the sake of the pasturage. A large part of the supply of firewood for Asheville formerly came from land now included in the estate. Under such treatment the forest, originally of moderate quality, grew steadily worse. The more valuable species of trees were removed, and the less valuable ones remained to seed the ground and perpetuate their kind. The fertility of the soil was destroyed by fire, while the young trees which grew up plentifully in many places were cut back year after year by the browsing of cattle.

The general objects of forest management at Biltmore are three in number. The first is profitable production, which will give the forest direct utility. If this were absent, the existence of the forest would be justified only as it lends beauty and interest to the estate. Second, a nearly constant annual yield, which will give steady occupation to a trained force, allow a permanent organization, and make regular operations possible. Third, an improvement in the present very mediocre condition of the forest, without which its future would be nearly hopeless.

Under the direction of Mr. Frederick Law Olmsted a collection of trees and shrubs has been made with the intention of planting them out, when they have attained a proper size, along the line of a road to be called the Arboretum Drive. This road, about five miles in length, will run through some of the most beautiful portions of the estate, and will be lined for a hundred feet on either side by the plants of the collection. It is the intention to make this arboretum one of the finest in existence. There are already in the nursery more kinds of trees and shrubs than there are in the Botanical Gardens at Kew, near London, and the number is being steadily increased. The climate will allow a larger variety of trees than that of any other large arboretum which has so far been begun, while the liberal plan of the work is intended to make the best use of so admirable an opportunity. A careful record of the treatment of each species is being, and will be, kept; while a forest botanical library, already of considerable extent, will furnish the necessary aid to study.

After the subtraction of all land occupied for any definite purpose, there remains at Biltmore considerably more than 1,000 acres at present lying waste, but which is to be used later on for planting forest trees. This land, composed of old clearings, is situated largely on the tops and shoulders of the hills, on the side toward the river. For the sake of the landscape it is important that these areas should be planted with trees, while the opportunity which thus arises is valuable along many lines. The climate of Biltmore permits the successful growing of an exceedingly large number of species. The space available is very large, and the nursery already established along the Swannanoa gives nearly perfect facilities for raising the seedlings. The plan upon which the forest planting is to be undertaken is a wide one and is likely to produce important results. We are acquainted with a great number of exotic species in their garden character; we know very few of them as to their adaptation to forest uses. Of the silvicultural character of American trees we are almost equally ignorant. It is intended, therefore, to plant blocks of an acre or more of each of a very large number of American and foreign trees, assigning each to the character of land which it is most likely to occupy with advantage. These blocks are to consist of both pure and mixed forest, and a record is to be kept from the planting of the seed, showing the yearly conduct of each species. Such an experiment may be expected, in the course of time, to add many important species to the useful forest flora of the country. While it is true that in general native trees are best, there are, nevertheless, very important instances where exotics have been exceedingly useful.

The list of seedlings now being raised in the nursery for forest planting includes twenty species, with an estimated total of 1,867,000 individuals. As may be inferred, the great majority of species for this work have not yet been planted, and those included above are largely standard kinds. The cost of raising young trees in a private nursery, such as that at Biltmore, not including interest on the ground, or the price of the seed, may be roughly estimated from the statement that two year old transplanted tulip tree seedlings, standing in the nursery rows, cost $3.35 per thousand; and four year old transplanted white pines $4.85 per thousand.

The continuation of the work at Biltmore along the lines already defined may be expected to yield much information of general value. The aboretum, from its situation and extent, will aid powerfully in determining the value of very many kinds of trees for a large part of the country, and will offer admirable opportunities for their study. The forest planting may add new species to our list of commercially valuable trees, and discover new uses for those already known. It will add greatly to our scanty silvicultural knowledge of the trees which it will contain. For the forest a still larger field of usefulness may be anticipated. The value of the methods already used in its treatment will be determined, new adaptations of the principles of forestry to American conditions will be developed, and information as to the business side of forest management will be gained. But above all, it will be useful in defining and helping to solve the problems with which American forestry must deal, and in awakening an interest in those practical details upon which its success in the future must so largely depend.

Obituary.

Heinrich Hertz.—The death of Dr. Heinrich Hertz, which occurred on January 5, robs electrical science of one of its youngest and most celebrated representatives. Born in Hamburg in 1857, he pursued a course of study in engineering up to 1878, when he turned his attention more especially to physics. In 1880 he received the degree of doctor of philosophy, after studying under Kirchhoff and Helmholtz, and was for three years the assistant of the latter, whom he left in 1883 to fill the position of *privat docent* at the University of Kiel. He became incumbent of the chair of physics of the Technical College of Carlsruhe in 1885, and finally, in 1889, succeeded the illustrious Clausius in the chair of physics of the University of Bonn, which he occupied until his death.

The attention of the scientific world was called to Hertz as long ago as 1886, the epoch at which he published his first researches relative to the action of violet light upon the electric discharge, soon followed by a study upon the velocity of propagation of electric induction. After these remarkable researches the scientific fame of Hertz was soon established. It dates from 1888, the epoch at which he succeeded in furnishing an experimental confirmation of the views of Faraday and Clerk Maxwell upon the propagation of electric waves in the surrounding medium. The learned experimenter showed that these waves produced by discharges of great frequency are identical in frequency and nearly in length to thermic or luminous waves. To this effect he devised in all their parts the means of producing such waves in a continuous manner and the apparatus that permits of analyzing them. This apparatus, which is now classic, is known as the resonator. He showed the reflection, interference, refraction, etc., of electric waves, and, through numerous experiments, confirmed the identity of all the different phenomena of radiation and their common origin—ether in vibration—the various phenomena being characterized only by the length of the waves and their frequency. The intimate nature of these vibrations still escapes us, and probably always will escape us, but we owe a grateful homage to those who are trying to lift the veil that hides the truth from us—an homage mingled with regret when death so prematurely and ruthlessly removes those who have best succeeded in this arduous task.

Edmond Fremy.—Science has just lost one of its most distinguished followers in the person of Edmond Fremy, who died at Paris on February 3, in the eightieth year of his age, having been born at Versailles on February 28, 1814. After finishing his studies, Fremy became preparator to Gay-Lussac at the Polytechnic School, where at this time Pelouze was assistant. Later on he succeeded, at the Polytechnic School and the College of France, Pelouze, who had become professor at these two establishments

The young professor replaced Gay-Lussac for some time at the Museum of Natural History, and finally succeeded his two masters in 1843 and 1850. Before occupying the chairs of chemistry of the Polytechnic School and Museum, he delivered lectures at the Central School and School of Commerce. In addition to the multiple duties of his professorships, he devoted himself to numerous researches in his laboratory. His important discoveries soon placed him in the first rank of the most distinguished chemists of our time. In 1857 he was elected a member of the Academy of Sciences in place of Baron Thenard. In 1879 he succeeded Chevreul as director of the Museum.

Decorated with the order of the Legion of Honor, the eminent scientist was promoted as officer in 1862 and as commander in 1878.

His first memoirs date back to 1835, and relate to the precious metals, gold and silver, and to the rare and little known metals of the platinum group. His researches upon ozone, in conjunction with Becquerel, upon the ammoniacal bases of cobalt, upon the fluorides, and upon the syntheses of the crystallized minerals, successively attracted attention and greatly contributed to the progress of the industrial arts.

We owe to Fremy some important work in organic chemistry. He added new facts to the history or production of the fat acids, the gums and pectic substances and shed a bright light upon all the subjects that he engaged in the study of. He devoted himself especially to the study of the immediate principles contained in plants. Contrary to the opinion of Payen, he showed that the genus cellulose, so to speak, contains several different species. He characterized vasculite, the origin of the ulmic substances. He likewise investigated the products derived from animals. As director of the Saint Gobain works, he introduced improvements into the manufacture of soda, sulphuric acid, glass and the products that are the basis of some of the modern industries. He devoted himself to numerous researches upon steel, cast iron, and gun metal, and discovered an alloy of iron and steel of remarkable tenacity. Toward the close of his life he published, in connection with Mr. Verneuil, one of his pupils, the results of his labors upon the artificial production of rubies. This was his last work.

Fremy's publications were very numerous. The *Traité de Chimie*, in six large volumes, by Pelouze and himself, has long remained the fundamental work of classic instruction. In 1881, he began the publication of a vast chemical encyclopedia, with the collaboration of the most competent scientists, and which is just finished. He published more than a hundred memoirs in the *Comptes Rendus* of the Academy of Sciences and the *Annales de Chimie*.

Pierre Joseph van Beneden.—This distinguished zoologist, who may be considered in paleontology as the successor of the great Cuvier, and who was born at Malines, Belgium, on December 19, 1809, died at Louvain on the 8th of January, 1894. He exhibited a rare aptness for the study of the natural sciences at an early age. He was passionately fond of the study of the marine fauna of his country and devoted himself ardently thereto. His first functions were those that he obtained in his youth of guarding the natural history collections of Louvain, and later on, in 1835, he was appointed professor at the University of Gand.

The labors and observations of Van Beneden upon the Cetaceæ are regarded by naturalists as of the highest value. He also made important studies upon the Annelids. His very numerous memoirs during his long career were communicated to the Academy of Sciences of Brussels, of which he was a member, and to the Academy of Sciences of Paris, to which Quatrefages generally presented them in the name of the Belgian naturalist. We owe to Van Beneden important works upon medical zoology and researches into the littoral fauna of Belgium. He had a remarkable talent as a draughtsman and most of the plates of his splendid works on natural history were the work of his own hand. He was in correspondence with all the most illustrious scientists of Europe and a member of nearly all the scientific academies and societies. One of his many contributions in aid of scientific work was the establishment at his own expense of a maritime laboratory at Ostend, which has since served as a model for others.

At the time of his death, he was one of the faculty of the University of Louvain.

Nicotine in Tobacco.

Dr. G. B. De Toni, Venice, has published the results of histochemical researches on *Nicotiana Tabacum* and other species of the genus. He finds the alkaloid, $C_{10}H_{14}N_2$, to be located chiefly in the epidermal tissues. It is absent from the seed and the young plant. In the root of the mature plant it occurs in the cortical tissue, and especially in the layer of cells immediately beneath the epidermis. In the branches, leaf stalk, lamina of the leaf, peduncle, calyx, and corolla, it is almost entirely confined to the epidermal cells, and occurs especially in those at the base of the hairs. It is found also, in smaller quantities, in the anthers and pistil. The mesophyl and assimilating tissue of the leaf gave uniformly negative results. Nicotine does not appear to exercise any protective influence on the tobacco plant, since both the fresh and the dried leaves are devoured by many insects. The author believes its function to be simply excretory; it is a product of the reduction of oxygenous substances. The following are given as the best chemical tests for nicotine: The double iodide of potassium and mercury; iodized iodide of potassium; tannic acid; tetrachloride of platinum; iodized iodic acid; Dragendorff's reagent; trichloride of gold.

A CARPET STRETCHER AND TACKER.

With this implement, after the carpet has been stretched to place, a tack is released from a magazine and guided in a conduit to the point at which it is to be driven, the releasing of the tack and the driving of it being effected by operating a plunger extending upward through the tubular handle. The improvement has been patented by Mr. L. M. Kenton, Urbana, Ohio. The device is preferably made of brass, except the tubular handle and plunger rod, and the toothed stretcher bar at its lower end has hinged side extensions, held extended by brace rods, the extensions and the brace rods being adapted to fold up beside the body. The tack magazine is in the form of a wheel having a toothed periphery, inside of which, on one face of the wheel, is a groove intended to receive the heads of the tacks, their shanks lying in notches in a flange which forms the

KENTON'S CARPET STRETCHER AND TACKER.

inner wall of the groove. A hinged cover fits closely against that face of the wheel in which the tacks are placed, and in this cover is a feed chute, adapted to receive one tack at a time as the wheel is revolved, the chute guiding the tack as it falls by gravity and holding it in upright position, to be driven into the carpet by the operation of the plunger, the feed chute being directly in line with the axis of the tubular handle. A spring extending across the path of the plunger is connected to a pawl which engages the ratchet teeth on the periphery of the magazine wheel, the arrangement being such that each time the plunger is withdrawn the wheel is moved the distance of one of its ratchet teeth, and drops a tack into the feed chute. Attached to the handle piece on the outer end of the plunger rod is a rubber buffer disk, preventing jar as the rod is forced through the tubular handle portion in driving the tack.

Four Thousand Ton Hydraulic Forging Press.

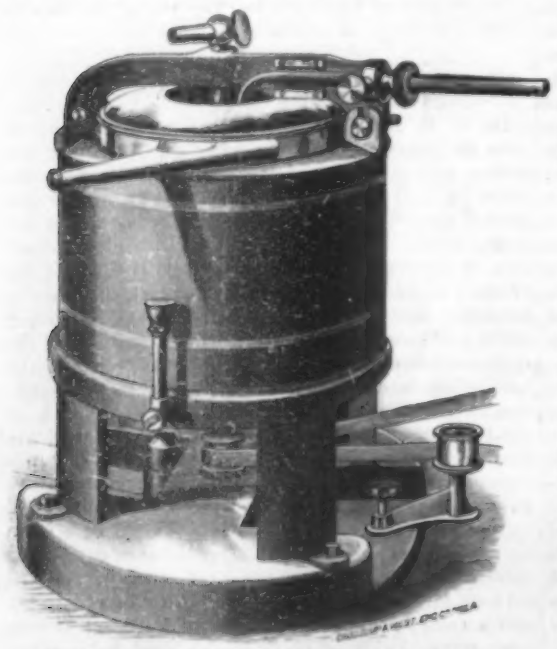
The Bochum Works, in Germany, employ hydraulic presses on a large scale for forging steel ingots, the most powerful being capable of exerting a pressure of 4,000 tons. The machine has a central piston of two different diameters, the lower part being 36·6 inches and the upper 29·87 inches, so that it is possible, with a water pressure of 9,000 pounds per square inch, to secure the pressure of 1,300, 2,700 and 4,000 tons respectively. The stroke of the piston is 3·28 feet, but can be varied at will. The return stroke of the main piston is accomplished by means of two other pistons of 10·24 inches diameter worked by a water pressure of 750 pounds per square inch. These pistons also serve as guides to the first mentioned one. The whole machine is made of cast steel. The main crosshead, which is in two pieces, weighs 64 tons; the cylinder weighed 57 tons in the rough and 35 tons finished.

The machine is operated by a valve which is movable by hand lever, whose total displacement is but 23⅝ inches, and which only requires an exertion of 4·4 pounds for its manipulation, as it is only subjected to a pressure of 750 pounds per square inch. This valve sends the water under this pressure to the pistons, which act as valves for admission and exhaust. The stroke of this valve may be divided into three parts: the first opens the exhaust, the second the admission of water at 750 pounds pressure, and the third that of water at 9,000 pounds pressure; this last only occurring after the head of the press has come in contact with the ingot to be forged—an arrangement that results in great economy of power.

The pressure of 4,000 tons is obtained by a steam pump with two cylinders, each 30 inches in diameter and 47 inches stroke, making 30 strokes per minute. These pumps deliver under a compressed air accumulator, whose plunger is 19¾ inches in diameter, and has a stroke of 8 feet 10¼ inches. The low pressure water is furnished by a two-cylinder pump, whose cylinders are 18 inches in diameter and 2 feet 3⅛ inches stroke, delivering under a weighted accumulator whose plunger is 21 inches in diameter and has a stroke of 9 feet 10 inches. All of these machines, including the accumulators, are in duplicate, to avoid delays due to possible accidents. The press is located in the center of a circular workshop 108 feet in diameter. Its top serves as the pivot for a radial crane, having a capacity of 275 tons, with the outer end of its jib carried upon a circular track. The furnaces are placed about the walls in two tiers, and are provided with various lifting appliances worked by an accumulator giving a pressure of 750 pounds per square inch.—*Moniteur Industrielle.*

REID'S IMPROVED DANISH CREAM SEPARATOR.

The use of centrifugal cream separators has for some years been a necessity with creamery owners. As is well known, these machines, run at a high speed, operate to separate the cream from the milk by reason of the lighter specific gravity of the cream, and it is little less than marvelous, to one unfamiliar with the business, how completely the butter fat may thus be separated from the milk, and how much more thoroughly the work is thus done than is any way possible by hand skimming. The accompanying illustrations represent an improved form of centrifugal cream separator, which is a modification of the old Danish-Weston pattern, as it is called in the United States, or the Burmeister and Wains of Europe. It is manufactured by Mr. A. H. Reid, of Philadelphia, whose long experience in this line has enabled him to introduce some important improvements, notably in the removal of the cream tube, which broke and frothed the cream as it operated in the Danish-Weston construction, and the substitution therefor of an overflow bowl, whereby also the capacity of the separator is increased. As will be seen from the sectional view, the milk is delivered in the center of the cylinder and passed down through the cone to the back of the cream wall. By means of the skim milk tube the skimming may be regulated while the machine is running, thus enabling one to make heavy or thin cream, and skim fast or slow. The main bearing is well up inside the center of the bowl, causing it to run very economically and effectively, and at a comparatively low velocity. The Farmer's Creamery Company, of Philadelphia, report running through this separator 3,000 pounds of milk per hour for six to nine consecutive hours, without cleaning, and skimming within one-twentieth of one per cent all the butter fat contained in the milk. Mr. Reid is also a large manufacturer of creamery fixtures and machinery.



IMPROVED CENTRIFUGAL CREAM SEPARATOR.

The Museum and Library of Alexandria.

The foundation of a museum and library at Alexandria is an interesting event in the career of modern Eygpt. The museum was formally opened in May, 1892, and the library soon afterward. By the terms of the foundation the institution will receive all the monuments of the Ptolemaic, Greco-Roman and Coptic periods, while Pharaonic antiquities will be sent to the museum at Ghizeh. Although the museum of Alexandria has not been opened quite two years, it is already rich in objects relating to the early history of Christianity. With the small sums at the disposal of the authorities of the museum the collections have been admirably arranged under the direction of Dr. G. Botti, and an excellent catalogue has been prepared.

The library possesses the nucleus of a fine collection, and additions to it from individuals and societies in all parts of the world are earnestly requested. The library will prove of great value to travelers in the East.

THE "CLIMAX" RATCHET STOCK.

This is a valuable tool for plumbers, steam and gas pipe fitters, gas and water companies, machinists, engineers, etc. It is designed to obviate the great difficulty and inconvenience ordinarily experienced in threading iron pipe in ditches, under floors, in corners, overhead, etc., as with this tool the threads can be cut on the pieces in any position with the greatest ease and convenience, not only saving time, but avoiding much unnecessary and disagreeable work. It has the combined utilities of a strong pipe vise and a pipe-threading stock, and is light enough to be carried readily in a tool bag, but is very strong, being made entirely of malleable iron and steel. It is a very handy implement for jobbing and country work, and when once used is found to be an indispensable tool. It is manufactured by the C. M. Kemp Manufacturing Company, of 1501 to 1509 Guilford Avenue, Baltimore, Md.

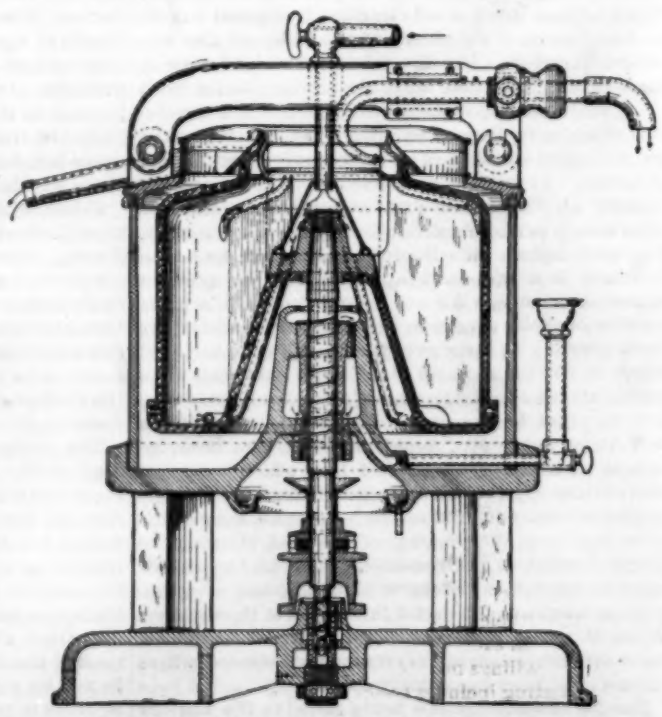
THE "CLIMAX" RATCHET STOCK.

Ship Canal between Lake Superior and the Mississippi.

There was recently submitted to the House River and Harbor Committee a measure for the survey of a canal route connecting Lake Superior with the Mississippi River. It is proposed by this plan to utilize the small streams at the source of the Mississippi as connecting links in a canal joining the Gulf of St. Lawrence with the Mississippi. Mr. Keifer has letters from the United States engineer officer stationed at St. Paul stating that the plan is entirely feasible. A private corporation has also been organized at Duluth to undertake the work. The projected canal is to have a width of 120 feet and a depth of 20 feet. It is also urged that it could be utilized to store the upper waters of the Mississippi and prevent the overflows which are so disastrous to the lower Mississippi.

The Gasoline Carriage.

At the recent tie-up of all the Steinway street railway cars at Long Island City, all connection with New York was entirely cut off, only the Daimler Motor Company was equal to the emergency, putting into service one of their motor carriages and connecting its two offices in Steinway and New York in this latest style. The carriage made quite a sensation as it sped along without the use of horses or electricity.



CENTRIFUGAL CREAM SEPARATOR—SECTIONAL VIEW.

AN IMPROVED SAD IRON.

The many advantages possessed by a smoothing iron such as shown in the illustration are apparent at a glance, and cannot fail to be appreciated by any housewife, laundress, or tailor. The cost of gas used is but trifling, and no extra fixtures are required, while the fuel used to heat the iron by a stove, in the ordinary way, is saved, and overheated rooms from this cause are avoided. The iron is finely nickel plated, and has in the rear an atmospheric burner, insuring perfect combustion, producing intense heat, with entire free-

THE BOLGIANO GAS-HEATED SAD IRON.

dom from soot. It is manufactured by the Bolgiano Water Motor Company, No. 415 Water Street, Baltimore, Md.

A NEW KIND OF CAMERA—"THE BULL'S EYE."

This camera, which has been placed on the market by the Boston Camera Manufacturing Company, 382 Tremont Street, Boston, has given excellent satisfaction. It requires no dark room, and the camera can be loaded and emptied in broad daylight. It is made and finished in the best manner, and has an achromatic lens, set to take pictures at any distance from eight feet upward, no "focusing" being required. It is small, being 5¾ × 4¾ × 4½ inches, and weighs less than

Fig. 1.

Fig. 2.

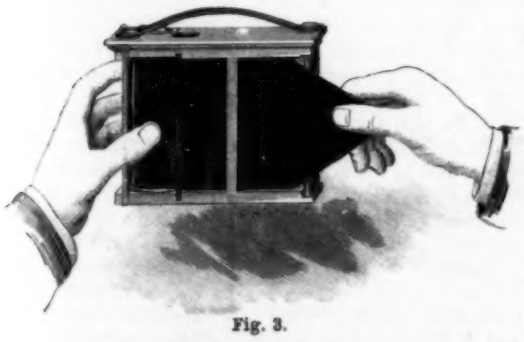


Fig. 3.

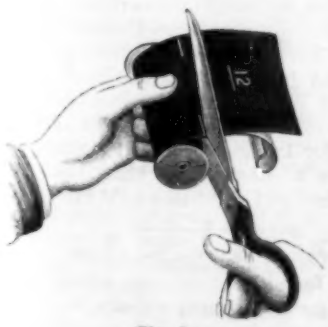


Fig. 4.

two pounds. A light-proof cartridge protects the film from light when loading and unloading by an opaque covering, so that one may carry a number of these cartridges and take as many pictures as desired, inserting the cartridge and removing after use in broad daylight anywhere. Fig. 1 shows the instrument in its case, and in Fig. 2 the case is removed from the camera. This shows the shutter and the way it is operated. The shutter is always set and is operated by pushing the spring alternately to right or left. The pointers on the shutter, as seen through the opening through the front of the camera, show which way to push the spring. The shutter is exceedingly simple in construction and the action is instantaneous, though it may also be adjusted for time exposures. The films are numbered from 1 to 12 consecutively in white figures on the back of the black paper strip which covers the film, and this number can be seen through the opening at the back of the camera, thus showing the number that is exposed and enabling one to keep a record of the same.

Fig. 3 shows the camera open to place the cartridge in position. The seal is cut, and resting the thumb against the cartridge, the end of paper is poked under cross piece, and drawn out about eight inches, as shown in cut. Then turning the camera over, so the reel will be on top and key toward you, pass the paper under cross piece, poke the end through the slot and turn key to left until the paper is secured. Slide the brass cover over the back and slip the camera into the case. A few more turns of the key winds up the opaque material to where the film begins, and camera is then ready for use. A "finder" is provided to locate the view properly, and one has only to aim camera and press the shutter spring for each picture, turning the key to bring a fresh part of the film into position.

Fig. 4 shows manner of cutting off films in a dark room preparatory to development, but it is not required for the user to do this, as after removing the cartridges from camera they may be mailed to the factory to have the pictures finished and returned. In the cut the film is shown under the black paper on which the numbers are seen, and the position of each exposure is shown by white marks on the edges of the black paper. The light-proof film cartridges are put up in very convenient shape for handling and are for twelve exposures only. Thus one does not have to wind off a long roll of film before getting any results, and as no dark room is required, there is no inconvenience in frequent loading when on a journey.

Simplicity is the dominant characteristic of this camera, and it is due to this and the improved American methods of grinding lenses by machinery that it is possible to sell a camera giving such a large percentage of good results, and finished in the best possible manner, for a moderate price.

The "Bull's Eye" lens is of fixed focus, but of such formation and adjustment that the objectionable features usual to this class of lenses are eliminated, and the "Bull's Eye" will make a clear, sharp picture at from eight feet to any distance.

This company issues a fully illustrated book and instructions for operating the "Bull's Eye" camera, which they will be pleased to send, with sample of work, to any address on application.

A FEEDWATER HEATER AND PURIFIER.

In this heater is arranged a filter provided with an outlet pipe leading to the boiler, and adapted to be connected with a filter inlet pipe, the filter being so arranged that it can be readily cleaned whenever desired without removal from the casing or stopping the flow of the feedwater. The exhaust steam enters the lower part of the casing, and above the point of its entry is arranged a series of spiral plates, onto the upper ends of which discharges a deflector, arranged under the cold water inlet, the valve controlling this inlet being actuated by a suitable mechanism from the accumulating water in the lower part of the casing. The uncondensed steam escapes to the atmosphere from an opening at the top of the casing. The spiral plates retard the progress of the water through the steam space, the dirt falling to the bottom of the heater, and the water is drawn off under a hood placed on the suction pipe, the lower edge of the hood being below the water level, to prevent the entrance of oil and other light impurities, which are taken off by an adjustable floating skimmer. The pump forces the heated water through a filter placed centrally in the steam space of the heater, in which it is kept boiling and thoroughly filtered, flowing to the boiler in a practically pure state. To clean the filtering material without stopping the flow of water to the boiler, valve A is opened and valve B closed, when the water flows direct from the pump to the boiler; the dirt discharge is then opened and live steam admitted at the bottom to blow out the dirt, hot water being also admitted, if necessary, by opening valve on by-pass under check. Hand holes at the top and bottom of the filter facilitate the ready insertion and removal of filtering material, and the ingress of water is controlled by a valve of special construction, actuated by a float which moves with the water level in the heater. At the bottom is a mud cock and large hand hole for blowing off accumulated dirt. For this improved feedwater heater and purifier three different patents have been issued to Mr. Joseph Bell, of the firm of Bell & Wildman, mechanical engineers, Troutdale, Oregon.

TRANSATLANTIC telephoning would be possible if a single copper wire could be laid.

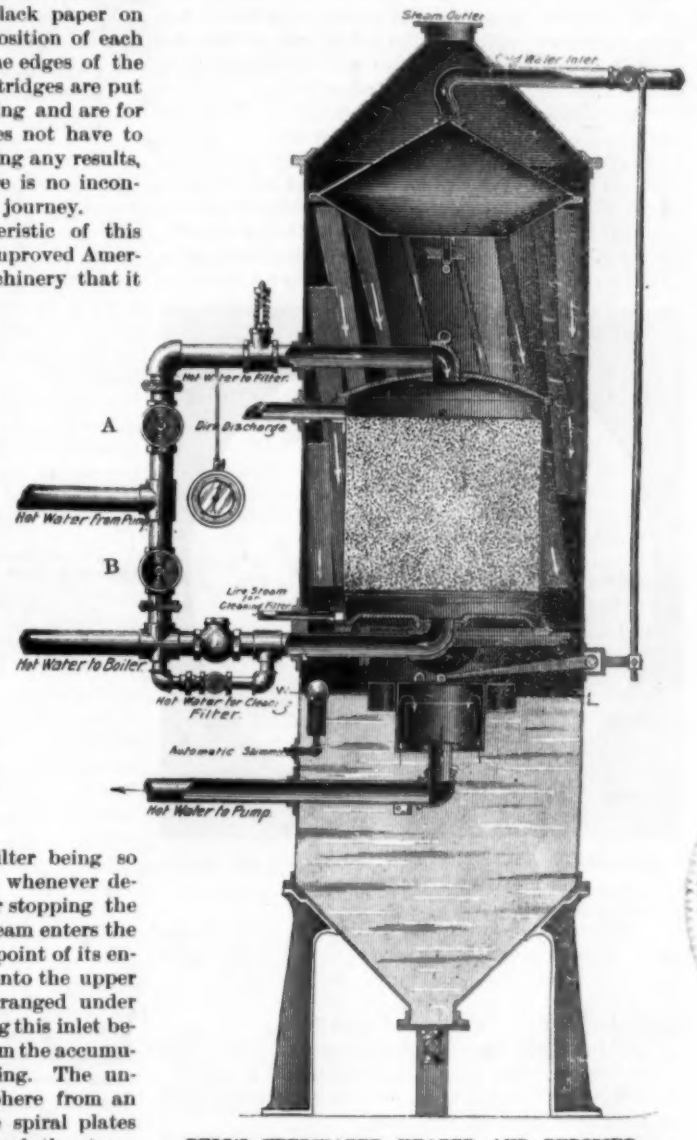
The Law of Trade Marks.

In the late litigation between the Columbia Mill Company vs. Alcorn et al. (14 Sup. Ct. Rep. 151), the Supreme Court had occasion to recompile the authorities upon this question, and concluded therefrom that the following general propositions were established:

(1.) To acquire the right to the exclusive use of a name, device, or symbol as a trade mark, it must appear that it was adopted for the purpose of identifying the origin or ownership of the article to which it is attached, or that such trade mark must point distinctively, either by itself or by association, to the origin, manufacture, or ownership of the article on which it is stamped. It must be designed, as its primary object and purpose, to indicate the owner or producer of the commodity, and to distinguish it from like articles manufactured by others.

(2.) That if the device, mark, or symbol was adopted or placed upon the article for the purpose of identifying its class, grade, style, or quality, or for any purpose other than a reference to or indication of its ownership, it cannot be sustained as a valid trade mark.

(3.) That the exclusive right to the use of the mark or device claimed as a trade mark is founded on



BELL'S FEEDWATER HEATER AND PURIFIER.

priority of appropriation; that is to say, the claimant of the trade mark must have been the first to use or employ the same on like articles of production.

(4.) Such trade mark cannot consist of words in common use as designating locality, section, or region of country.

Petroleum as Fuel for Steamships.

The British steamship Baku Standard, a bulk oil carrier, arrived at Philadelphia recently from Shields, England, having burned on the passage liquid fuel only. The trip was an unusually trying one, the vessel having been caught in Arctic drift ice and detained so that the passage required 26 days. The oil (petroleum residuum) is sprayed by a steam jet, and the boilers are protected by brick. The consumption was about 20 tons for every 24 hours. The residuum was from Russian oil, but on the outward trip Pennsylvania oil will be used. The number of firemen required was reduced by 12, there being on duty only two boiler tenders and two greasers at a time. The Baku Standard is owned by A. Suet, of London. She registers 3,705 gross tons, and is 330 feet long, 43 feet beam, and 23 feet depth of hold. She carries over 1,200,000 gallons of petroleum in bulk, and goes to Russia as well as to the United States for oil.

LARGE RECENT SUN SPOTS.

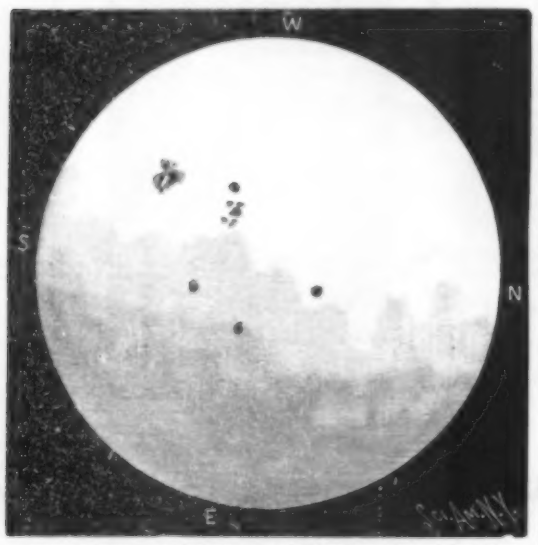
The face of the sun has of late been an object of special interest to astronomers in all parts of the world, by reason of the very large spots in view upon the disk.

These spots were seen by the naked eye on February 22 last, toward sunset, by our valued correspondent at San Diego, Cal., Mr. M. Y. Beach, who states that in the evening, two hours after sunset, a brilliant aurora borealis appeared at different points near the coast and in Oregon and Idaho. Our correspondent wrote to Professor Holden, director of the Lick Observatory, describing the phenomena. These spots, it was learned, had been under observation and study at Mt. Hamilton for a considerable period prior to their notice at San Diego. Dr. Holden caused to be transmitted to our correspondent a couple of photographs of the sun's disk, taken at the observatory, showing the location and comparative magnitude of the spots, and from one of these photos. the accompanying engraving has been prepared. In the letter to our correspondent accompanying the photographs Secretary Perrine says:

"Lick Observatory, University of California,
"Mount Hamilton, March 2, 1894.

"At Professor Holden's request, I take pleasure in sending you a print from a negative taken on February 24, showing the large group of sun spots in south latitude which was visible to the naked eye, as well as a number of smaller ones. I also send a print showing the January appearance of this same group.

"These larger groups are often visible in their various stages of increase and decrease for several months, so that it is hard to see any very intimate connection between them and the sudden electrical disturbances which occur on the earth. This is a subject which is not definitely settled, although the tendency seems to be not to place so much confidence in their connection as formerly. There appears, however, to be no doubt



SUN SPOTS RECENTLY PHOTOGRAPHED AT LICK OBSERVATORY.

of a connection between the periods of greatest solar activity and terrestial magnetism, as instanced by the period of oscillation of the earth's magnetic pole.

"A number of faculæ are also visible on both these photographs near the east and west limbs of the sun.

"We have just passed one of the eleven-year periods when the sun spots are a maximum, and it is probable that this spot will be the largest one for several years, or until near the next maximum.

"Under separate cover is Publ. No. 28 of the A. S. P., containing some items of interest in this connection by Lord Kelvin."

A recent number of the *Daily Graphic*, London, contains a copy from a photograph of the sun's disk, showing the spots, taken at the Royal Observatory, Greenwich, on Wednesday morning, February 21. It corresponds closely with our present engraving. According to the *Daily Graphic:*

"The rare phenomenon of aurora borealis, as far as London was concerned, was visible on Wednesday night, when there was a magnificent display of the 'Northern lights.' It was first noticed soon after 7 P. M. in the form of apparently luminous clouds in the northern and western portions of the sky, and reached a maximum about 8 30 P. M., at which time a brilliant arc, extending from N. W. to N. E., and about 12° high in its highest point, was the chief feature, with occasional shoots of streamers toward the zenith.

"It is almost an established fact that these phenomena are strongest when the disturbances on the sun are greatest, so it is by no means extraordinary that such a marked display should succeed the great sun spot, of which an account was given last week.

"Another remarkable coincidence with these displays is the magnetic disturbances and interruptions of telegraphy which invariably take place, so that we may expect to hear of numerous instances of the erratic behavior of the telegraphic needle."

Nature of March 1 states that during the foggy days of last February, when the brightness of the sun was not too great to permit direct observation, a sun spot, which was very plainly visible to the naked eye, attracted general attention. It was first seen in the southeast quadrant on February 19, and will probably pass off the visible disk about March 2. It has been somewhat remarkable for its relatively large penumbra and the scattered character of the umbra; a very distinct nucleus was also observed. In the course of an interview, Mr. Maunder stated that the spot was at a maximum on February 20, when it was about 48,000 by 46,000 miles, and the area 1,870 millions of square miles. It was therefore much smaller than the great spot of February, 1892. Though the magnetic disturbances have not been so great as in the case of the 1892 spot, a marked effect on the Greenwich recording magnets was noticed at 3:15 P. M. on February 20, the disturbance lasting about twenty-seven hours. After an interval of about twenty-four hours, another and more intense storm commenced, and reached a maximum at 3 P. M. on February 23. In the case of the spot of February, 1892, the violent magnetic storms occurred after the spot had passed the central meridian; but in the present instance, the disturbances seem to have preceded the central transit of the spot.

The following are the observations of Lord Kelvin alluded to in Secretary Perrine's letter:

"ON THE QUESTION OF THE INFLUENCE OF THE SUN UPON MAGNETIC STORMS ON THE EARTH. [BY LORD KELVIN, PRESIDENT OF THE ROYAL SOCIETY.]

"Several communications to the Royal Society on the subject of simultaneous magnetic disturbances found by observations at magnetic observatories in different parts of the world justified him in saying a few words regarding terrestrial magnetic storms, and the hypothesis that they were due to magnetic waves emanating from the sun. Considering probabilities and possibilities as to the history of the earth from its beginning to the present time, he found it unimaginable but that terrestrial magnetism was due to the greatness and the rotation of the earth. It seemed probable, also, that the sun, because of its great mass and its rotation in the same direction as the earth's rotation, was a magnet with polarities on the north and south sides of its equator, similar to the terrestrial northern and southern magnetic polarities. It was, therefore, a perfectly proper object for investigation to find whether there was or was not any disturbance of terrestrial magnetism, such as might be produced by a constant magnet in the sun's place with its magnetic axis coincident with the sun's axis of rotation. Even if (which did not seem very probable) we were to be led to believe that the magnetic force of the sun was directly perceptible on the earth, we might be quite certain that this steady force was vastly less in amount than the abruptly varying force which, from the time of Sir Edward Sabine's discovery, forty years ago, of an apparent connection between sun spots and terrestrial magnetic storms, we had been almost led to attribute to disturbing action of some kind at the sun's surface. It had been a very tempting hypothesis that quantities of meteoric matter suddenly falling into the sun were the cause or one of the causes of those disturbances to which magnetic storms on the earth were due. We might, indeed, knowing that meteorites fall into the earth, assume without doubt that many more of them fall in the same time into the sun. Astronomical reasons, however, led him long ago to conclude that their quantity annually, or per century, or per thousand years, was much too small to supply the energy given out by the sun in heat and light radiated through space, and led him to adopt unqualifiedly Helmholtz's theory that work done by gravitation on the shrinking mass was the true source of the sun's heat, as given out at present, and had been so for several hundred thousand years, or several million years. It seemed very improbable that meteors fall in at any time to the sun in sufficient quantity to produce dynamical disturbances at his surface at all comparable with the gigantic storms actually produced by hot fluid rushing up from below, and spreading out over the sun's surface. The magnetic storm of June 25, 1885, showed that in eight hours of a not very severe magnetic storm, as much work must have been done by the sun in sending magnetic waves out in all directions through space as he actually does in four months of his regular heat and light. This result, it seemed to him, was absolutely conclusive against the supposition that terrestrial magnetic storms were due to magnetic action of the sun, or to any kind of dynamical action taking place within the sun, or in connection with hurricanes in his atmosphere, or anywhere near the sun outside. It seemed as if they might also be forced to conclude that the supposed connection between magnetic storms and sun spots was unreal, and that the seeming agreement between the periods had been a mere coincidence. We were certainly far from having any reasonable explanation of any of the magnetic phenomena of the earth; whether of the fact that the earth was a magnet; that its magnetism changed vastly, as it did from century to century; that it had somewhat regular and periodic annular, solar-diurnal, lunar-diurnal, and sidereal-diurnal variations; and (as marvelous as the secular variation) that it was subject to magnetic storms. The more marvelous, and for the present inexplicable, all these subjects were, the more exciting became the pursuit of investigations which must, sooner or later, reward those who persevered in the work. We had at present two good and sure connections between magnetic storms and other phenomena; the aurora above, and the earth currents below, were certainly in full working sympathy with magnetic storms."

A CARTRIDGE SHELL EXTRACTOR.

This device, for removing broken cartridges or their shells from a rifle bore, has recently been patented by Mr. Rodolfo P. y Cubillos, of Bogota, Colombia. Fig. 1 is a perspective view of the device, the free end portions of which are shown in section in Fig. 2. It consists of spring fingers whose lower ends are formed into cutting edges, one of the fingers being grooved to form cutting edges adapted to split or divide the lodged shell, while the other somewhat shorter finger is internally flattened at its extremity. These fingers operate conjointly, when the device is forced by a ramrod down the grooves of a rifle in which is a broken or lodged cartridge or shell, the longer finger cutting the shell in two, while the shorter one, with its flattened or pointed extremity, enters behind the loosened shell and acts as a cutter or wedge and pusher to dislodge the shell. This device is not an attachment for a rifle or firearm, but a separate device made of fine and highly tempered steel.

CUBILLOS' CARTRIDGE SHELL EXTRACTOR.

Great Mines of California.*

The gold mining business in California has seldom looked brighter than at the present time. Old abandoned mines are now being opened out and worked with success; water, improved methods of extracting and milling the rocks, cheap labor, and reduced cost of supplies enabling the miner to work rock to a profit for what it cost him to mill it in the early days.

I feel confident that if the same amount of capital now being spent in the African gold mines were *judiciously invested* in our California gold mines the results would be so satisfactory as to again attract miners from all parts of the world. One instance of the results of judicious investment of capital in California was the Eureka mine. The enterprising Jules Fricot purchased it, and in 1864 sunk a perpendicular shaft to the depth of upward of 100 feet, which intersected the *pay shoot* at that depth. He then built a quartz mill and erected hoisting and pumping machinery. He afterward disposed of part of the property to a San Francisco company, who took out $5,700,000 from the claim, a large proportion of which was paid in dividends. The Idaho and Maryland claims are a continuation of the Eureka pay shoot, and in the same fissure. The Coleman Bros., to whom Grass Valley is so greatly indebted, first bought the abandoned North Star mine, made a success of it, and then sold it for a large sum of money. They then commenced work on the Idaho, which, by good management, has proved so far to be the richest mine in California, yielding in the neighborhood of $12,000,000, and, it is said, nearly one-half of that has been paid in dividends. No mining capitalist on this coast has developed richer gold mines than Alvinza Hayward, Esq., and his operations have not been confined to a few localities. With good judgment and practical knowledge he has opened out old abandoned mines, and, with the aid of improved machinery, made them good paying concerns. For instance, the Utica mine, the output of which for a considerable time has been greater than the richest of the African gold mines.

An Alloy which Adheres to Glass.

M. F. Walter has found that an alloy consisting of 95 parts of tin and 5 parts of copper adheres so tenaciously to glass that it may be employed as a solder to join the ends of glass tubes. It is obtained by adding the copper to the tin previously melted, agitating with a wooden stirrer, casting or granulating, and then remelting. It melts at about 360° C. By adding from a half to one per cent of lead or zinc, the alloy may be rendered either softer or harder, or more or less easily fusible. It may also be used for silvering metals or metallic thread.—*Rev. Scientifique.*

* Conclusion of Melville Attwood's paper on "Metalliferous Deposits," read before the Academy of Sciences, March 5, 1894.—*Mining and Scientific Press.*

THE NEW SPEEDWAY ON THE BANKS OF THE HARLEM RIVER, IN NEW YORK CITY.

The people of the city of New York are gradually realizing the fact that in the northern part of the island of Manhattan and in the country adjacent thereto they possess one of the most picturesque regions that any metropolis can boast of. The Harlem River, which is a sort of estuary, running nearly north and south, defines for its length the eastern limit of the island. The western shore of this river, beginning at its southern end, for part of its extent is flat and uninteresting. At about 158th Street the ground changes, and for a distance of some three miles the bank rises precipitately in places to a height of over 100 feet. The river then gradually merges into Spuyten Duyvil Creek, soon to be replaced by a ship canal. Here its waters connect with those of the Hudson River. A flat region forms the upper portion of its west shore—a region known as Dyckman's Meadows. The eastern shore is also high, far less precipitous than the western side, but enough so to give a character of great beauty to the portion of the course of the river lying north of 158th Street. Two beautiful bridges cross the river above this point, one the High Bridge, a many-arched stone aqueduct, and the other farther north, the twin arch girder steel structure known as the Washington Bridge. The view to the north from the latter looking up the valley is hard to surpass. One of our cuts gives a bird's-eye view of the region described, and the map gives the general relations of the locality to the city streets.

Some years ago a movement was inaugurated by those interested in horses for a speedway within a reasonable distance of the residential portion of the city. It was proposed to build one in Central Park. Several reasons militated against this. The area of the Park, restricted at the best, is greatly encroached on by two reservoirs, so that there is hardly room even for the present uses. Much popular opposition was also expressed to the project of placing it in the Park. Then the happy idea was conceived of building a speedway along the western shore of the Harlem River, utilizing the most picturesque portion of it just described, a portion which otherwise would remain unexploited or worse for many years to come. Operations are in active progress on the construction, and we illustrate some of the present features of the work.

The general course of the speedway is north and south, following closely the river edge for the greater portion of its route. Starting at its southern end, it begins almost at the western end of the 155th Street viaduct, running to the north at about right angles thereto. Here it is about one hundred feet above high water mark (city datum). It gradually descends with a slope of 0·0391, or nearly four feet in one hundred, until at about 165th Street it reaches its river grade, which is six feet above high water. Again it gradually rises to a seventeen foot elevation at High Bridge, and with other rises and descents reaches the six foot river grade at its northern end. To maintain it a retaining wall over forty-two feet high is to be built at its starting point. Then as the river level is reached cribwork is to be erected to support portions of it, of which cribwork there are three principal stretches, besides some smaller pieces. This is the only temporary feature of the work, and one which is a necessity. Under the conditions of the ground, stonework would have been of prohibitive cost. The map shows the situation of the speedway, and its connections north and south.

Dyckman's Meadows have already been mentioned. There the speedway ends, meeting with Dyckman Street, which runs obliquely toward the west, and connects with the Kingsbridge Road, now termed Broadway. For its entire length no side street will connect with the speedway. The contour of the ground is responsible for this sort of isolation, which is really one of its best features. The termination of the speedway is at about 198th Street, giving a total of forty-three blocks, or, measured on the center line, of 11,558 feet.

It comprises for its entire length a roadway with east and west footpaths. The roadway at its lower end at 155th Street is seventy feet wide. At 165th Street it is one hundred feet wide, and it holds this until about 171st Street, when it narrows enough to pass under one of the arches of High Bridge, being there 63½ feet wide. Again it widens to eighty feet, and at about 178th Street narrows, so as to pass the blow-off house of the Croton aqueduct, with a width of sixty-one feet. At the Washington Bridge, a short distance north, it has to go through an archway but 54·6 feet wide. This is its narrowest portion. After passing this point it again widens to one hundred feet.

The surface of the roadway is to be the best possible representative of what a horseman terms a "dirt road." The macadamized road is too hard for fast work, and the speedway is designed for speeding horses. The general system of construction is as follows: The roadway is to be filled with clean material, no rock being allowed within one foot of the subgrade. This subgrade is a short distance below the final finished or surface grade of the roadway. For the foot below subgrade only clean earth, free from clay and with no stones over three inches in any dimension, and with not more than fifty per cent of such stones is to be used. This as spread is to be rolled with at least a two ton roller. On this a layer of broken stone is spread and rolled with a six or eight ton roller. All of this stone must be of size to pass through a sieve with two inch holes, and to be retained by one with one inch holes. On the broken stone cinders are spread and rolled with at least a two thousand pound roller. Two layers of sandy loam, each rolled with a two ton roller, complete the surface.

The speedway is provided with footpaths on each side. The western path, running along the riverside, is nearly of the grade of the roadway for its entire extent. It varies in width, owing to the difficulties of the ground, varying from ten to twenty feet in width. The inner or western pathway varies from twenty to thirty feet in width. On the down grade of the southern portion of the speedway the walks are of concrete; where the cribwork underlies them, they are made of gravel to allow for the inevitable settling. A striking feature of the western path will be its variations in grade. In one place it is to be twenty-eight feet above the surface of the roadway. This height is required by the Washington Bridge, whose shore piers rest upon the surface rock, which it would be unsafe to disturb. This walk goes through other archways at both High Bridge and Washington Bridge than those through which the roadway passes.

The plan provides for several arched subways running under the roadway, one near 163d Street, two at High Bridge, and two at Washington Bridge. In general dimensions these will be twelve feet wide and eight feet high to the crown of the arch. The idea is to avoid the necessity of people on foot crossing the roadway. The question of intermediate access to the footpaths is not fully settled. There will be one such approach at Washington Bridge, and probably others.

It will be seen that the natural and artificial difficulties of the work are very great. The High Bridge, the Croton aqueduct blow-off house, and the Washington Bridge are the main obstructions. The fixing of a bulkhead line prevents encroachment on the river; so that the engineers have very fixed lines within which to work.

One of the cuts illustrates well the difficulties encountered in the surveying operations due to the precipitous ground. In the distance in this cut appear the arches of High Bridge. The cut showing the section of the roadway illustrates the necessity for a gravel walk where it rests on cribwork, and shows the road as established on the rock. The extensive use of cribwork is a feature of the construction, and a section and face elevation of this is given in one of the cuts. The illustration of the blasting operations gives a good idea of some of the difficulties encountered.

To realize just what has to be done, the cut of the ground in its present condition may be contrasted with that showing the finished speedway. On the western side of the speedway is seen the footwalk cut out of the cliffs and rising and falling in its course. This will afford an admirable vantage ground for spectators who wish to watch the horses. The western walk will afford fine views of the river on the occasion of boat races. The law authorizing the construction of the speedway restricts its use to private vehicles. Presumably there will be no restriction, or a very liberal one, as regards the speed allowed. The work will probably be completed within eighteen months or two years.

Our thanks are specially due to Mr. Charles H. Graham, the engineer in charge.

Leonard Smokeless Powders.

The ingredients of the Leonard powder, according to the patent specification, for the United States 30-caliber rifle are given as follows:

150 parts by weight of nitroglycerine.
50 parts by weight of guncotton.
10 parts by weight of lycopodium.
4 parts by weight of finely triturated urea crystals, but the proportions are varied according to the caliber of the gun which is to use it.

If dinitrobenzol be employed in the manufacture instead of finely triturated urea crystals, a similar quantity, namely, four parts, should be used. The several ingredients named above are first mixed together, and there is then introduced as a solvent either acetone alone or acetone combined with acetate of amyl or acetone combined with acetic ether. The solvent is evaporated by agitation, and the material is formed into a cake or granules by pressing in moulds. The analysis of cordite, which we give for the sake of comparison, is as follows:

Guncotton as previously used at Waltham Abbey	37 parts.
Nitroglycerine	58 "
Vaseline	5 "
Total	100 "

The solvent here used is again acetone, the proportion being 19·2 parts. The mixture is incorporated for three and one-half hours, and is then squeezed into threads. If the "scouring" and "pitting" actions which accompany the use of cordite are obviated in the "Leonard" powder, a bright future is before it.

Correspondence.

Cancer—Its Cause and Treatment.

To the Editor of the Scientific American:

I notice in your issue of February 10 an article on cancer. Allow me to say that I have made a special study of the cause and treatment of that disease for twenty-five years. The theory that inoculation by erysipelas would prevent or cure cancer has been exploded years ago.

The treatment of cancer by the knife is purely mechanical, and has been described by our best authorities on surgery as only palliative, and never a cure for the disease.

I can say that in my own experience I have never known a single case of cancer cured by a surgical operation. About one-sixth of the cases that come under my treatment are hereditary. We may lay it down as a general law in regard to the cause of cancer that anything that has a tendency to weaken the vitality of a person may predispose to the development of the cancer germs in the system. We then only need a local irritation to cause its appearance upon the surface. The successful treatment of the disease must then, of necessity, be constitutional and local. Nothing but a complete renovation of the blood and the annihilation of every cancer germ within its current can be counted as a cure.

It has been claimed that certain kinds of food will cause cancer, viz., tomatoes, pork, etc. The first is, i itself, a very good blood purifier; the latter I do no think ever caused cancer; but there is a very common cause of cancer, and that is the adulteration of the food and drink that is used by the masses at the present day. I claim that this is one of the chief causes that account for the rapid increase of cancer. Good food and healthy drinks well digested make good blood. Herein is a good preventive of cancer. Be regular in your habits; be temperate in all things; don't worry. Remember that worry weakens the nervous system and predisposes to the development of cancer or consumption. In England we find that in 1838 cancer caused one death in 140 of the total mortality; in 1890 one in 28 of the total mortality. In the United States 36 out of 1,000 deaths are due to cancer.

The most successful physician in the treatment of cancer is one who treats each case according to the diseased condition that exists. In no other way can this fearful disease be intelligently and successfully treated. The time for experiments and theories is past. What the people want now is a cure for this malady.

ELI G. JONES, M.D.,
(Dartmouth Medical College, N. H., 1871.)
Paterson, N. J.

Effect of Fire on Concrete.

Concrete is often used as a fireproof building material, and as such, says *The Architect and Builder*, is commonly considered a safe material for walls or foundations which may be built for that purpose. A few experiments will demonstrate its unreliability in this respect. Take a piece of dry and hardened concrete work, such as is used in walls or foundations and break it into three parts or lumps, leave one in its original state, and place the other two pieces in the fire, where they should remain at a light red heat for five to fifteen minutes, according to size; then remove both pieces, place one to cool naturally and the other in water to cool. When cold and removed, it will be found that the one naturally cooled will crumble easily and the one cooled in water will crack and fall apart with very slight pressure.

Some two years ago we had an experience with concrete walls, where the interior of a two story building had been destroyed by fire. We recommended that the walls be taken down and rebuilt; but it was decided to repair them. Where the fire was light, but little damage was done; but near the base of the walls, where the burning brands had fallen and the fire generated the greatest heat, was a strip all round that had crumbled away, leaving the walls at this point only about half their original thickness. The most pronounced of the disintegrated concrete work was cut out and brick work built in; soon afterward the exterior portion of the walls showed signs of giving way, whereupon sections were cut out and built in with brick. As time passed, the walls in the other portions also began to show the disintegrating effect of the fire on concrete work.

We wish more particularly to direct the attention of the officers of the various fire departments to the danger which may attend concrete work, especially where the basement or foundation portion of the walls has been built of such material, and which in turn supports brick walls, three or more stories in height.

In many cases the concrete work is placed where the fire and steam together will tend to weaken the support, and in a moment, without warning, the walls may come tumbling down over the firemen, repeating the horrors frequently depicted by the press.

CIVIL engineering became important about 1750, when Smeaton began Eddystone lighthouse.

AMERICAN MANUFACTURE OF FIRE CRACKERS.

Most of the fire crackers used in our Fourth of July celebrations are imported from China. Recently a plant for their manufacture was started in this country, and they are able to compete with the foreign cracker, on which there is a duty of 200 per cent. This new Uncle Sam cannon cracker is made of an explosive composition of chlorate of potash, bichromate of potash and charcoal, the substance being confined in a cylindrical tube made of strawboard. The top or upper end of the tube, through which a spun cotton fuse passes, is plugged up with New Jersey clay, and the bottom end with cork. The plant employs outside of their works from 30 to 40 families making the strawboard tubes, which run in size from 2½ inches to 8½ inches in length, and ranging in diameter from ⅛ to 1½ inches. With the discharge everything is blown to atoms, leaving no burning fire afterward, as is the case with the discharge of the Chinese cracker, which often causes serious damage. The first process in the manufacture of this cracker is the forming of the tubes. The strawboard is first cut into different lengths and widths according to the size wanted, the small strips being about 10 inches in length and 2½ inches in width, the other sizes being cut in proportion. About 50 of these strips are given a coat of paste and then placed between the tracks on the forming board. A steel forming roll is then placed on the track and an end of one of the strips pressed fast to it; the attendant then by a quick forward movement of the hand causes the pasted strip to be taken up and formed into a tube in about a second. A good hand can form about 2,000 per day. After forming they are racked and left to dry about three days. After drying the tubes are placed on a brass nipple board. This board consists of seventy-two circular brass pins or nipples, the exact diameter of the interior of the tubes, and about three-quarters of an inch shorter, over which they are placed, each pin having a small circular hole down through the center. The fuse, which is filled inside with fine gunpowder, is placed into this hole and a quantity of clay is put into the top of the tube, which is rammed down good and tight on the top of the brass nipple, forming a solid plug, and also holding the fuse in place in the center. The tubes are then taken off of the nipples and put into what are called forms. These forms are made of wood, and are perforated with 72 holes, circular in shape, the same diameter as the outside of the tubes, each tube being placed fuse down in them, the tops of which project about one inch. A cover containing the same number of holes and of the same diameter is then forced over the tops of the tubes, which are then ready to receive the explosive composition. This composition passes down through the cover into the tubes, which, when filled, are taken away to be corked. About five pounds of the exploding composition is required to charge a gross of the small size crackers. The cork plugs are of the same diameter as the interior of the tubes and are about one-quarter to one-half inch in thickness. They are glued in by girls, and then covered, after first having the ends primed or dipped into a solution composed of saltpeter and nitrate of lead. The covering is done on marble slabs. A number of the red covers are pasted at a time and laid one over the other so that the ends are about one half inch apart. The cracker is placed over the top cover, the end sticking fast to it, and the operator, by a quick forward motion of the hand, rolls the cover in less than a second. The crackers, after drying, are packed into boxes ready for the market. Sixty hands turn out about 50,000 crackers per day. The sketches were taken from the plant of Charles Gerhard, Greenville, N. J.

Fig. 1.—GENERAL VIEW OF GAILLARDET'S STEAM CARRIAGE.

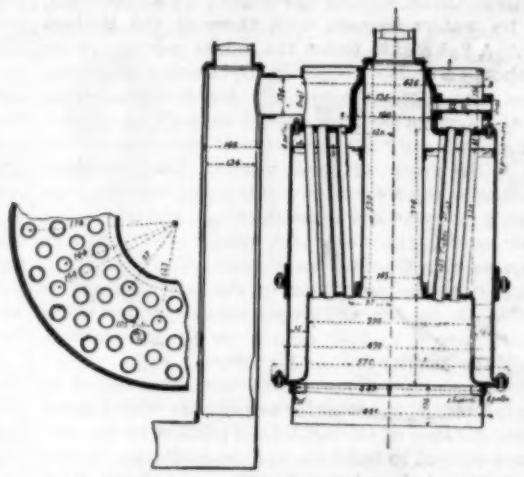
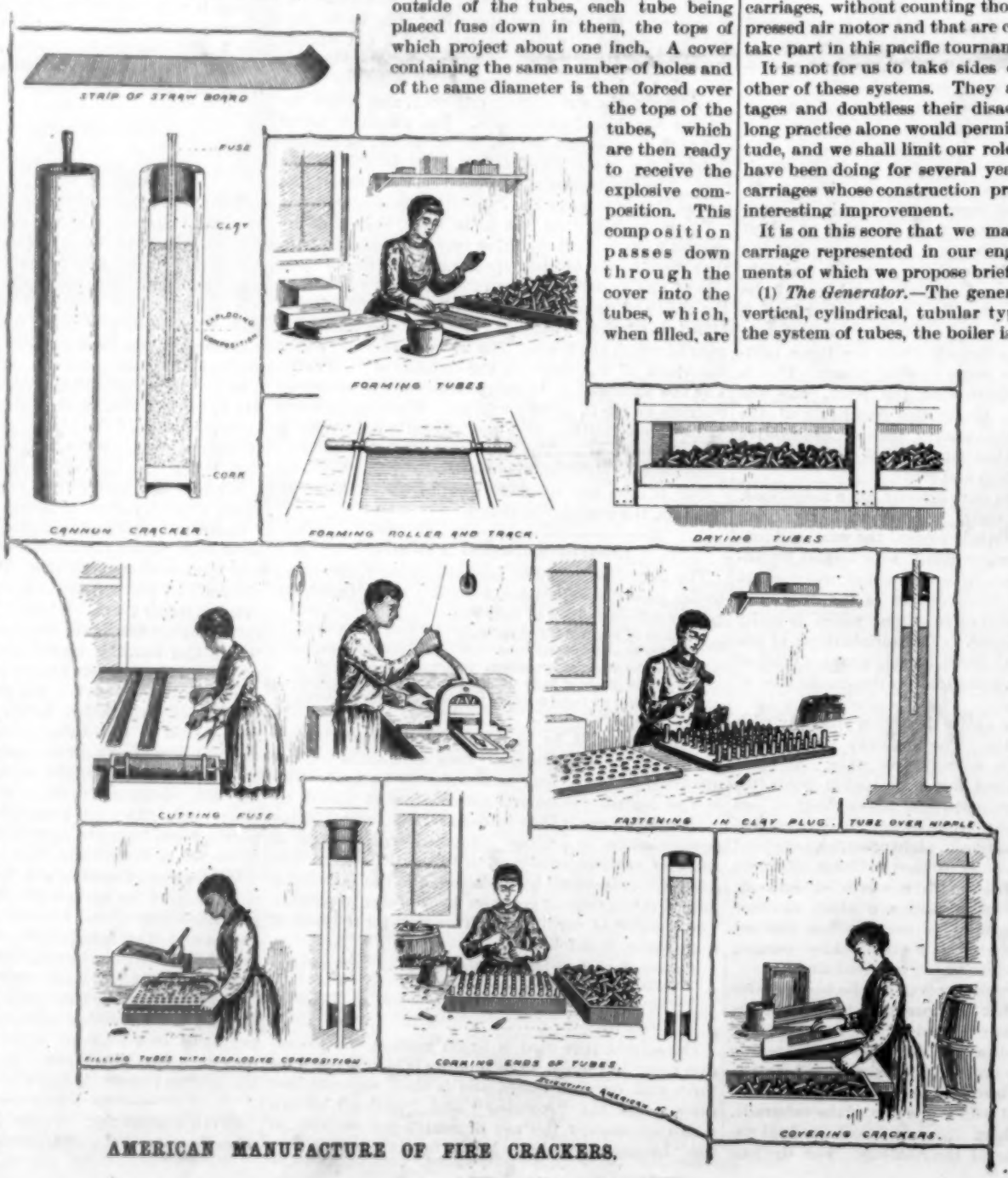


Fig. 2.—VERTICAL SECTION AND PARTIAL PLAN VIEW OF THE BOILER.



AMERICAN MANUFACTURE OF FIRE CRACKERS.

NEW STEAM CARRIAGE.

While waiting until electricity shall have put in its last word concerning the propulsion of vehicles, a warm contest is continuing between steam and petroleum carriages, without counting those actuated by a compressed air motor and that are coming in their turn to take part in this pacific tournament

It is not for us to take sides either with one or the other of these systems. They all have their advantages and doubtless their disadvantages also, that a long practice alone would permit of fixing with exactitude, and we shall limit our role to describing, as we have been doing for several years past, those of our carriages whose construction presents some new and interesting improvement.

It is on this score that we make known the steam carriage represented in our engravings and the elements of which we propose briefly to describe.

(1) *The Generator.*—The generator (Fig. 2) is of the vertical, cylindrical, tubular type. Independently of the system of tubes, the boiler is provided with a central tube for charging with fuel from the top and forming a reservoir permitting of running for a certain length of time without the fire having to be looked after. As the chimney descends toward the ground, it permits a draught to be set up only when the exhaust of the engine induces it, so that there is no annoyance from excess of steam at the moment of stopping or during a slowing up. The tubes are inclined and spread outwardly toward the top in order to permit the steam produced to disengage itself easily without any priming; moreover, an obstruction obliges the steam to pass through the entire bundle of tubes outside of the water in order to become superheated thereby. Finally, the jacket of the boiler is easily removed for the convenient and sure

cleaning of the interior. The total heating surface is 43 square feet, the volume of water is 9 gallons and the weight of the naked boiler is 350 pounds. The heating is done through coke, by preference. The putting under pressure requires a quarter of an hour.

(2) *The Engine.*—The engine is composed of two Wolff four-cylinder elements that actuate two cranks keyed at an angle of 90°. It is provided with a Stephenson slide reversing gear. The high and low pressure cylinders are upon the same rod in each element and each slide valve is actuated by the same rod. The minimum ratio of expansion is 4 to 1. The diameter of the small cylinder is 3 inches and that of the large one 5 inches. The steam may be admitted directly into the large cylinders for starting up or for the ascent of gradients. The common stroke is 4 inches. The pistons are of steel and the entrances of the slide valve rods and piston rods in the end planes of the high and low pressure cylinders are provided with metal stuffing boxes. The speed of the engine is capable of reaching 500 revolutions without inconveniences. Each element or couple is guided by its feed pump, which is in the prolongation of the cylinders. The pillow blocks are of cast steel, as are also the cylinder covers and the valve boxes. The frame is of forged iron. The crank axle carries the driving pinion. The engine is capable of developing a maximum power of six horses. Its weight is 286 pounds. The lubrication is effected through grease of a consistent nature, so that no dust can reach the movements. The lubricating is done in the morning and lasts for a day's run, without any further attention having to be paid to it. The cylinders are lubricated by means of condensation lubricators. All the pieces in motion are of steel, and present the maximum of lightness compatible with a solidity proof against anything. All the frictions are upon mangano-phosphor bronze.

(3) *Transmission in Motion.*—The motion of the engine is transmitted to the driving wheels, which are 36 inches in diameter, by means of two absolutely silent steel gearings, whose ratio is 1·3 to 2. The driving pinion is keyed directly to the shaft of the engine, between the two cranks. The gear that transmits motion to the wheels contains in the interior of the hub a differential movement with pinions, with which it is connected by a Cardan joint that permits the driving axle of the carriage to take any inclination whatever with respect to the shaft of the engine, and thus does away with a chain and its motions.

Finally, the frame carrying the boiler and engine is completely independent of that forming the seat, so that none of the jarrings of the engine is felt by the passengers, and it is in perfect equilibrium upon the front wheels. When it is desired to inspect the engine, it suffices to remove the axis that connects the two frames and to cause the seat to tilt backward—a very simple operation that renders all parts of the engine as accessible as possible for a close inspection. In running, it suffices to lift the floor in order to have all the movements within reach of the hand.

(4) *Setting in Motion and Steering.*—The two steering wheels are mounted upon a pivot (Jeantaud system), so that a collision of the tire of one of the wheels with any object is transmitted to the pivot without influencing the steering, the carrying point of the wheel being sensibly at the center of the axis around which the wheel pivots. Moreover, the axis of rotation of the other wheel is situated behind its axis of pivoting, and this carries the vehicle along automatically in a straight line in moving forward.

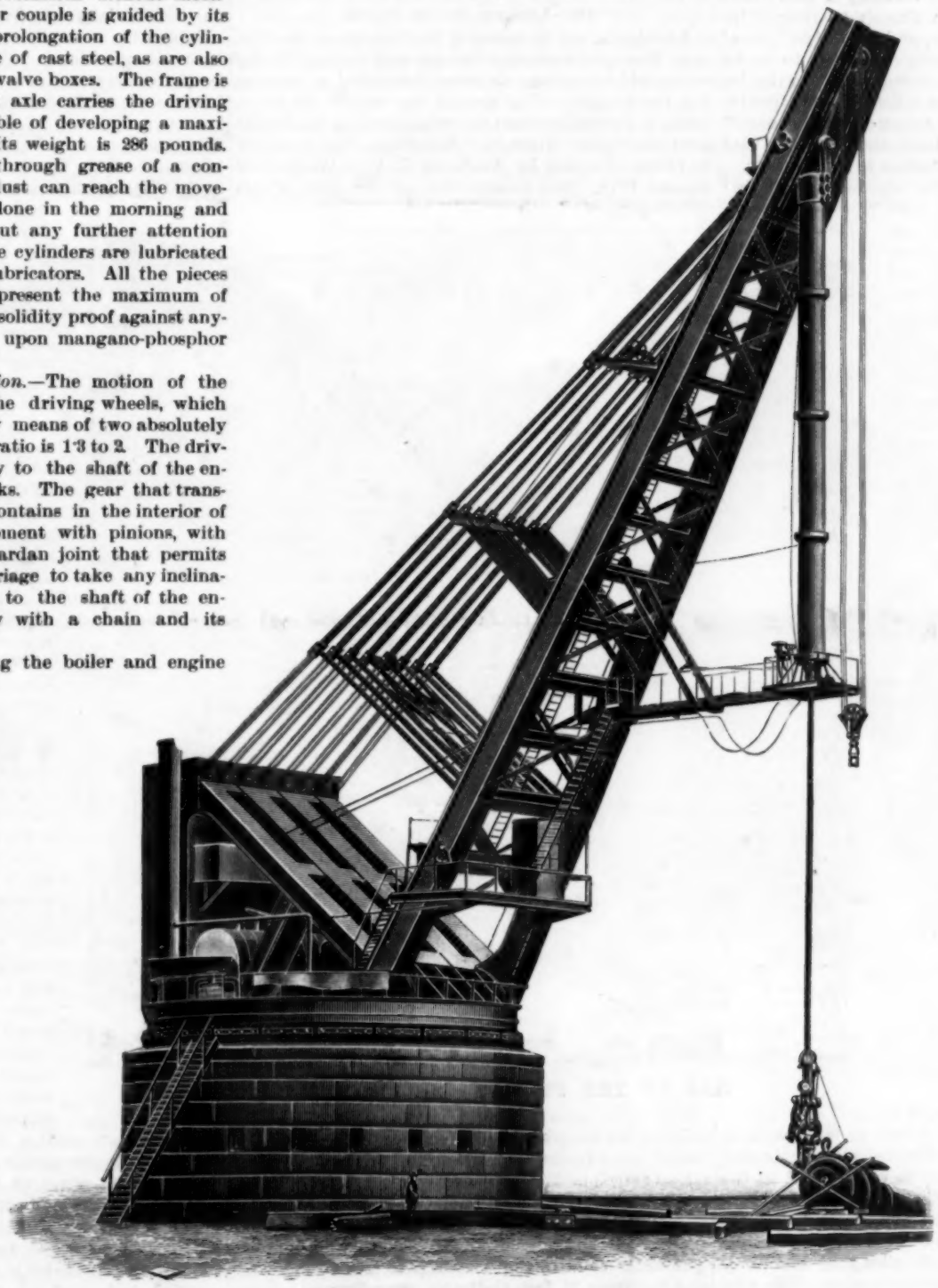
The two wheels are united by a connecting rod, which assures the concordance of their motions, and which a jointed rod connects with a steering bar, similar to that of bicycles, in order to give the direction by revolving it in one direction or the other. This steering bar, moreover, is connected with the reversing gear, so that, always transmitting the direction, it is possible, by inclining it toward the front or rear, to obtain what one desires from the engine, from a run at full speed, in passing through all intermediate speeds, to a stoppage and a running backward. In descents, the engine holds back more or less or stops the carriage instantly, if the motorman desires it. As the latter has in hand, for steering and changing the speed, but a single apparatus, the steering bar, which is so simply and rapidly maneuvered that no confusion or error is possible, the carriage is rendered more tractable to his caprices than the most docile or best trained horse.

(5) *The Carriage.*—The front of the carriage consists of the boiler, surrounded by the coke box and by all its accessories—steam ports, blower, injector, cylinder lubricator, safety valves, water levels, pressure gauge, feed valve boxes, blow-off cock, and chimney damper. At the rear there are seats for four persons, including the motorman, and beneath is situated the water tank. The water entrances of the pump are under the hand of the motorman. Under his foot is situated the pedal of a winding brake. The system of seat and engine frames is suspended with the greatest care by means of two large 3½-foot springs upon the back and a system of 4-foot elliptic springs, that suspend the front at three points, so as to leave it just the stability necessary, while giving it much easiness for steering and a minimum of stress for the traction absorbed by the two front wheels that carry the boiler and engines. By way of compensation, this system places all the stability upon the driving wheels, and thus concurs toward their adhesion. The wheels are of wood.

The coke box has a capacity of ten cubic feet, allowing of making a mean trip of three miles. The maximum speed measured has reached twenty-seven miles per hour, but this does not mean that twenty-seven miles can be made in one hour. The maximum made has been fifteen miles traversed in one hour. This, again, is an exaggerated speed, and, however perfect be the machine, is very dangerous. It is prudent never to exceed a maximum of nine and one-half miles with automobile carriages.

The carriage, empty, weighs 2,530 pounds. This carries the maximum weight, water, coke, passengers, etc., to 3,520 pounds, equally distributed upon the four wheels, for the type of French cab represented in Fig. 1. It is possible with this carriage to ascend gradients of 1·25 inch to the foot.

The exhaust steam before reaching the chimney, which is situated beneath the carriage and is directed toward the rear, passes into an iron tube situated upon the grate of the furnace, wherein it becomes superheated in order to escape in an invisible state. The inventor of this carriage is Mr. Gaillardet, of Paris.—*Les Inventions Nouvelles.*



IMPROVED 160 TON CRANE.

IMPROVED 160 TON CRANE.

The fine crane which we illustrate has been erected at H. M. Dockyard, Chatham, by Messrs. Tannett Walker & Co., engineers, Leeds, and is thus described in *Engineering*, from which our engraving is also derived. The crane may be considered as a combined steam and hydraulic crane, as the hydraulic system is only used for lifting heavy loads, light loads being lifted by tackle worked by steam power, which is also used in revolving the crane. The crane in question is capable of lifting a load of 160 tons to a height of 50 feet, this being done on the so-called direct-acting system, by means of a hydraulic cylinder fitted with piston and rod. The extreme range of the crane is 75 feet 3 inches, and the height of the jib end sheave from the quay level is 125 feet. The full load of 160 tons is raised by means of hydraulic pressure, and there is a wire rope with block hook for lighter loads up to 30 tons. The roller path on which the crane revolves is 45 feet 4 inches in diameter. As will be seen, the crane is mounted on a massive masonry foundation, to which the roller path is firmly bolted. The rollers are mounted on a live ring, and, being closely packed, give a good distribution of the load. The framing of the crane is of the most massive character, a very rigid structure being thus obtained. The counterweight is fixed behind the boiler, as shown to the left in our engraving. The boiler is of comparatively large size, viz.: 18 feet long by 7 feet 8 inches in diameter, and is of the horizontal type. It supplies steam to three pairs of engines, of which one set pumps the water for the hydraulic cylinder, another set revolves the crane, while the third set works the wire rope tackle used in lifting light loads. After its erection at Chatham, the crane was tested with a load of 320 tons, which it carried without difficulty. The total weight of the structure is, we may add, about 500 tons.

Manufacture of Fulminate of Mercury.

An improved method of making this dangerous explosive is as follows: 10 grammes of mercury are dissolved in the cold in 120 grammes of nitric acid (sp. gr. 1·45). When the solution is complete and the liquid cold, this liquid is poured into a flask containing 110 grammes of alcohol (95 per cent strength). Action soon begins, without the application of heat, and is allowed to develop and then cease naturally. The mass is then treated with water until no longer acid, and when it has been slowly dried, it is ready for use.

A POWER plant on the upper waters of the San Gabriel River, Cal., is shortly to be constructed for the purpose of furnishing electricity for power and other purposes for use in the Azusa valley. There will be 30,000 feet of six-foot cement tunnel through a mountain cliff, from which the water will fall 400 feet into the cañon below. The work is estimated to cost $250,000, besides the power and the electrical machinery. It is claimed that the machinery will be in operation within a year. The aim of the projectors is to locate manufacturing enterprises in that locality to use all the power.

THE STEIN EXPEDITION TO ELLESMERE LAND.

This region of poetic but unfamiliar name lies to the northwest of Baffin's Bay. Bounded on the east by Smith Sound, on the south and west by Jones Sound, and on the north by the body of water now known as Hayes Sound, it is supposed to be a triangular area about twice the size of the State of New York. The proposed expedition for its exploration has received the indorsement of the National Geographical Society, and the preparations are in charge of Mr. Robert Stein, of the United States Geological Survey.

The first object of the expedition is to make search for the two young Swedish naturalists, Bjorling and Kallstenius. They started in June, 1892, from St. John's, with three men as crew, in a little schooner, the Ripple, intending to coast along the west shore of Greenland, and collect specimens. Their last letter to Prof. Nordenskiold stated that their vessel ran aground in August of that year, and in October they were preparing to start for Ellesmere Land with provisions enough to last until January 1, 1893. Last June, Captain McKay, of a Scotch whaling ship, found the wreck of the Ripple, and the body of one of the crew, on the Cary Islands. He tried to make Ellesmere Land, but his time was limited, the ice blocked his passage, and he failed in the attempt. The supposition is that if the young scientists are still living they are on Ellesmere Land, and it is hoped that Mr. Stein's party may arrive in time to rescue them.

The estimated expense of the expedition is $10,000; of this sum $6,500 had been subscribed on the ninth of January last. At that date no less than sixty young men had volunteered to go, though the services of but ten can be accepted, unless a larger sum of money is guaranteed. The command of the expedition has been offered to Prof. Nordenskiold.

If the remainder of the needed money is pledged, the party will be ready to leave St. John's on a whaler by the first of next May.

A definite plan of operations has already been agreed upon by the Advisory Committee, consisting of Commodore G. W. Melville, of the Navy, Dr. T. C. Mendenhall, Superintendent of the United States Coast and Geodetic Survey, and General A. W. Greely, of the Army. It is proposed that the whaler land the men at Cape Tennyson, if it can be reached; if not, on Coburg Island or North Devon. As soon as they can get to the southern point of Ellesmere Land, a house is to be built and provisions for two years are to be stored in it. While four of the men are building, the others are to begin the exploration along the west coast and at an advance post, a hundred miles or so from the first, they are to establish a second depot for supplies. About the first of September the men will all reassemble at the southern station and go into winter quarters. Early the next spring the explorations will be renewed, and it is hoped that they may extend to Greely Fiord.

In September, 1895, a whaler is to bring the party back to St. John's or land them in Scotland. A steam launch, sledges, whaleboats and dogs bought in Greenland are to be included in the equipment of the party. Commodore Melville, of Jeannette fame, says: "With a well supplied depot to fall back upon and a good whaleboat, there is hardly a point of any coast of 300 to 500 miles that cannot be reached with safety." General Greely says: "The west coast of Ellesmere Land is, in my opinion, the one field of exploration in all the Arctic that promises the largest results with the least amount of labor and danger. With a good boat and provisions for the party at the entrance of Jones Sound, four or six active young men should be able, with ordinary caution, to trace at least 300 miles of that unknown coast with perfect safety during a single summer."

Next in importance to the relief work of the expedition is the scientific investigation for which these nearly eighteen months in high latitudes will give opportunity. While Smith Sound and Jones Sound were both discovered by Baffin in 1616, and Smith Sound has been traversed by all, or nearly all, the searchers for the pole, Jones Sound has been visited only three times and explored for but 100 miles.

It is believed that this expedition will make important discoveries in regard to its coast lines and its waters. Observations in meteorology and magnetism will be constantly made by competent men. The geology of Ellesmere is thought to be of special interest as likely to throw light upon the glacial period. Sir George Nares found there "a flora surprisingly rich" and a fauna ranging from musk oxen to mosquitoes.

The Anthropological Society of Washington indorse the expedition and authorize the appropriation of the sum needed to send a skilled authropologist, whose special duty it shall be to study the tribe of Eskimo reported to be living on Ellesmere but not known to have been seen by white men.

Previous Arctic explorers have met with so many forms of unexpected disaster that they have perhaps added not so much to the sum of scientific research as to the records of heroic suffering and sacrifice. Mr. Stein and his co-workers believe that, profiting not less by the failures of these brave men than by their successes, they are making such provision for this prospective expedition that the dangers of the men will be reduced to the minimum, and that their work will furnish long-sought answers to many puzzling questions.

MAP OF THE PROPOSED ARCTIC EXPEDITION.

The Longest Swing Span.

A bridge is now in course of erection across the Missouri River, between East Omaha and Council Bluffs, which will be remarkable when completed as possessing the longest swing span in the world—520 feet—being 15 feet longer than the swing span of the bridge over the Thames River, in Connecticut. The structure has been designed by Professor J. A. L. Waddell, of Kansas City. The construction of the pier of this swing span was completed a few months ago and presented many features of interest to engineers. From a long article in *Engineering News* it appears that the work was begun by sinking a steel caisson for a foundation, much as A. P. Boller started work on the swing span of a large bridge in New York City a year ago. The outer shell of the caisson is 40 feet in diameter and the inner 20 feet, the latter spreading out at the base to join the former and thus give a cutting edge. Both shells are made of half-inch steel, re-enforced at the lower edge, where they meet, by two bands of inch steel, one inside and the other outside. The two shells were kept in their proper relative positions by braces running between them, of which there were twenty in all, made of half-inch plates. The caisson proper is 16 feet high. Above this the two steel cylinders extend to a height of 100 feet, making a total of 116 feet from the cutting edge to the top of the cylinder. Above the caisson the plates are reduced in thickness to three-eighths of an inch, and are braced by bars and rods rather than the heavier and more costly plates required in the lower part. The friction of the earth against such a long cylinder is very great, and to reduce it a number of pipes run down the whole length of the caisson and shell. These open at the bottom of the caisson and at intervals of ten feet above, so that by forcing water through them it was possible to diminish the hold of the surrounding earth on the steel. The space between the two shells was filled with rubble concrete. The sinking progressed with no more than the usual delays; as the shells went down under the weight of the concrete placed between them, aided by the removal of the earth within by means of bucket dredges, plates were added to the top until the whole was at the required depth. The masonry pier built on top of this cylinder is of limestone backed by concrete. It is 38 feet in diameter and 18½ feet high.

Trial of the Thirteen Inch Guns.

The trial of one of the twelve 13-inch guns took place at the Indian Head proving ground on the Potomac, near Washington, on March 22. The 13-inch guns are the largest ever built in the United States. The 13-inch guns were built for the battleships Indiana, Massachusetts and Oregon. One later battleship, the Iowa, will carry nothing larger than 12-inch guns, which are likely to be the heaviest hereafter used in any navy, according to the opinion of the best ordnance experts. The first forging for one of the new 13-inch guns was made in 1890, so that nearly four years elapsed before one of the guns was completed. The gun itself weighs sixty-five tons and rests in a saddle weighing ten tons. The gun is managed by means of hydraulic machinery. The rifling grooves are fifty-two in number, and give the shell a gradually increasing rotation until when it leaves the muzzle it is rotating at the rate of seventy-three turns a second. The forgings for the big guns were made by the Bethlehem (Pa.) Iron Works, and the guns were finished at the Washington navy yard. The cost of one of these monsters is about $60,000, and every shot with a steel projectile costs $700.

An iron projectile weighing 1,100 pounds was propelled by a charge of 408 pounds of brown hexagonal powder. The velocity of the first projectile fired was 1,720 feet a second. For the second and last shot the charge of powder was increased to 480 pounds, with the result of increasing the velocity to 1,975 feet per second. It is estimated that with a charge of 550 pounds of powder a muzzle velocity of 2,100 feet per second would be produced, which is sufficient to drive an armor-piercing projectile through 23·42 inches of steel at 1,500 yards. The trial of the big gun and also a 10-inch and 4-inch gun was witnessed by Secretary Herbert, as well as a number of congressmen, army and navy officers.

The Flying Machine.

At a recent meeting of the Physical Society, Berlin, Prof. Du Bois Reymond, president, spoke on Lilienthal's experiments on flying. As a starting point he had chosen the study of the flight of birds, which may be divided into three distinct kinds—flapping, steering and soaring. Of these the one demanding least expenditure of energy is soaring, and investigation showed that under certain conditions flight is possible if the wind possesses a vertical component. Experiments showed that surfaces can acquire a horizontal motion by the action of the wind only when their curvature bears a certain relation to their superficies, and that this relation corresponds exactly to that which is observed in the wings of birds. Dr. Lilienthal's flying machine consists of a correctly curved surface whose area is 14 square meters, made by stretching linen over a light wooden frame and having a weight of about 20 kilos. In its center is an aperture for the experimenter's body, and the apparatus is held in position by the person's arms. On running rapidly down a gentle slope of a hill against the wind, the latter soon acquires a vertical component, which then carries the flying apparatus and propels it in a direction against the wind. The speaker had seen Dr. Lilienthal sail over a space of about 120 meters, at an altitude of some 30 meters, in a minute; with a favorable wind it was possible to cover some 200 to 500 meters, and Dr. Du Bois Reymond had himself taken leaps through the air of 20 to 30 meters under similar conditions. He was of opinion that by practice far better results may be obtained as regards soaring, and that then, by combining steering with soaring, it will be possible to fly even when the wind is unfavorable. It appears that the three essentials for the solution of the problem of flight are (1) correct utilization of the wind, (2) the correct shape of the supporting surfaces, and (3) correct handling of the apparatus.

IT is estimated that by improper methods in the Pennsylvania mines, 30 to 40 per cent of the anthracite coal was formerly lost.

THE SIBERIAN TIGER IN HAGENBECK'S MENAGERIE.

The tiger has usually been considered an inhabitant of the tropics—although it has long been known that he is hunted in China—and it was not commonly known, until Russia gave more attention to the cultivation of Siberia, that he is found even beyond the 50th degree of latitude. To live in this climate, the tiger of Siberia must necessarily be a different animal, if not of a different species, from that of India. By a glance at our engraving (for which we are indebted to our worthy contemporary the *Illustrirte Zeitung*) it will be seen that his hair is much longer, so that the hair on the neck looks like a mane, and his tail is double the ordinary size, and yet, as shown here, his winter coat has only begun to form. The very thick hair on other parts of his body gives him the appearance of a gigantic cat, and is doubtless sufficient protection against the most severe cold. The Siberian tiger seems to surpass his cousin of the south in size also, for this creature, which, according to Hagenbeck's calculation, is about two and one-half years old, measured 1 yard 3 inches to his shoulder on December 1. In the three months that he had been in Hagenbeck's possession he had grown nearly two inches, and it was thought that he would grow about four inches more. The tameness of this ferocious-looking beast is surprising, and leads to the supposition that it was caught very young, and was raised by a native family. It was sent from Vladivostock to Japan first, then to the Hamburg Zoological Garden, and from there it came into Hagenbeck's possession. It is the only nearly full grown animal of its kind that was ever carried to Europe.—*Illustrirte Zeitung.*

THE SIBERIAN TIGER.

Suburbs of Ancient Rome.

There were great obstacles to the extension of the suburbs of Rome. The roadsides were occupied with sepulchers of twenty-five generations, and it was forbidden by feeling as well as by law to dwell within a certain prescribed distance of the remains of mortality. The performance indeed of certain ceremonies sufficed to desecrate these hallowed spots, but if we may judge from the well known monuments of the dead which have been discovered even within the Porta Appia, and still more numerously in quite recent times beyond it, it would seem that on this, the most frequented of all the Roman ways, there was little use made of such a privilege. When two centuries after our era Caracalla proposed to erect his vast public baths, he found, we may suppose, little impediment from private buildings at only half a mile's distance from the Porta Capena. The Grotto of Egeria, almost immediately under the Servian walls, continued in the time of Juvenal to be surrounded with a grove, the resort of beggars, idlers, and the lowest classes of the people. There was a distinct village at the Milvian Bridge, about three miles from the Capitol, but in the immediate neighborhood we read of rural villas and pastures. That there was no suburb below the city on the river banks may be proved from the absence of any trace or record of a bridge across it. It is remarkable, again, that our accounts of various events which took place a little outside the walls indicate the solitude of the country rather than the character of populous suburbs.

Sale of a Great Auk's Egg—Price 300 Guineas, or $1,500.

A large company gathered at Mr. Stevens' auction rooms, King Street, Covent Garden, recently—said the *Daily Chronicle*—attracted by the sale of an egg of the great auk, with rather an interesting history. The specimen was contained in a small box, 6 inches by 4 inches, with a glass cover, and it was only by peering through that the egg was to be seen. To have permitted the public to handle it, inasmuch as it was slightly cracked at the broad end, might have tended to its complete destruction.

Mr. Stevens, pausing in the sale of rare British and foreign eggs, and arriving at Lot 112, the great auk, said: "Now, gentlemen, comes the exciting event of the day. It is not the first egg of the kind that has been offered for sale in these rooms; but it is one of the most beautiful and interesting specimens ever seen. It was formerly in the possession of Mr. Yarrell, then of Mr. Bond, and next of Baron d'Hamonville. It is not quite perfect, but it is beautifully marked. It was originally purchased for a few francs of a French fisherman near Boulogne, after he had arrived home from a whaling expedition, so that we can trace its history almost from the day it was laid. It is not quite so good as the one sold last year for £225. Five years ago only sixty-seven specimens were known to be in existence, but after that another was found in a loft, making sixty-eight altogether. Of that number sixty-six are in Europe and two in America. I trust this one will remain in Europe. In reality it ought to go to the British Museum, from the peculiar interest which is taken in these eggs. The last one was sold a year ago for £225, and I have heard that the purchaser made a very fine profit out of that transaction. (Laughter.) This particular egg was sold in these rooms in 1856 for 20 guineas at the late Mr. Yarrell's sale, and now I trust you will make liberal bids for it, so that a fair value may be obtained. It will be safe to start at 100 guineas, as I can do that for myself." The next bid was 110 guineas, and by tens 200 guineas was rapidly reached. Then there was a pause, but Mr. Stevens, with a little coaxing, and saying that he hoped to obtain 300 guineas at least, when he should be happy, started the bidding again at 210 guineas. Another pause, followed by Mr. Stevens informing the company that there was no reserve, and that when the egg had been sold any intending purchaser would lose all chances of recovering it. Then came a bid of 220 guineas, followed by others of 240, 250, 260, 270 and 280. Mr. Stevens (to a gentleman in the middle of the room): "Surely you will not let it stop at this price. Are you quite sure you have made up your mind?" Another bid of 290 guineas was the result, amid cheers, and then Mr. Stevens pathetically appealed to his audience to go as far as the 300 guineas, and more than that he said he would like to get if possible. A gentleman who stood near to him raised his pencil, and the figure was secured. Then came the formal announcement of 300 guineas once, twice, and the third and last time, and the hammer fell to the agent of Sir V. H. Crewe, Bart. Mr. Stevens afterward informed a reporter that the sum realized was the largest one for any auk's egg that had as yet been submitted under the hammer.—*Pall Mall Budget.*

Farm Lands Wanting Potash.

1. Fodder crops, pasture grasses, corn stover, and hay all remove large amounts of potash from the soil, and these crops occupy a large proportion of our improved lands.

2. The urine of our domestic animals contains about four-fifths of the total potash of their excrements.

3. When urine is allowed to waste the manure is poor in potash.

4. When manures are exposed to rains, much of the potash, being soluble, is washed away.

5. Nearly all the special fertilizers are especially rich in phosphoric acid, and do not contain enough potash.

6. Superphosphates were the first fertilizers to come into general use among our farmers.

7. When the farmer buys a fertilizer, he still, nine times out of ten, calls for a phosphate.

8. As a result of the above conditions, our soils seem to be quite generally in need of more liberal applications of potash.

9. In the case of corn the need of potash appears to be particularly prominent.

10. For a good crop of corn the fertilizer used should supply 100 to 125 pounds of actual potash per acre; 200 to 250 pounds of muriate of potash or one ton (50 bushels) of good wood ashes will do this.

11. With ordinary farm or stable manure it will generally pay to use some potash for corn; 125 to 150 pounds of muriate of potash has given profitable results.

12. The liberal use of potash means more clover in our fields, more nitrogen taken from the air, more milk in the pail, a richer manure heap, and storehouses and barns full to overflowing. It means also a sod which when turned will help every other crop.

13. For the potato crop the sulphate appears to be much superior to the muriate of potash, promoting both yield and quality in much higher degree; 300 to 400 pounds of high grade sulphate of potash furnishes enough of this element.

14. For oats, rye, and grass, nitrate of soda applied just as the growth begins in spring has proved very beneficial; 300 to 400 pounds per acre should be applied.—*Prof. W. P. Brooks, Massachusetts Agricultural College.*

A SHIP which loaded recently at Wilmington, Del., for Brazil, had as part of her cargo five locomotives, 25 first-class passenger cars and 180,000 feet of lumber.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—George M. Hull, Kearney, Neb. In this engine the cut-off devices are combined with and operated by the rotary piston shaft, and are so arranged to serve as an automatic governor, adjustable relatively to the speed of the shaft. A double pair of piston abutments is also provided, one abutment of each pair being drawn forward by live steam while the other set is faced forward under steam expansion, although, by the adjustment of cams, the piston may be forced a greater or less distance by live steam.

ROTARY PUMP.—Charles Rumley, Helena, Montana. This pump is strongly made, and has but few pieces. It consists of a cylinder in which an oscillating valve is fulcrumed between inlet and discharge pipes, the valve having a port constantly open to the inlet pipe, while a revoluble piston pivoted at one end of the valve follows the wall of the cylinder and fits against the inner faces of the valve. The pump may be used to pump foul gases from mines or as an air pump, while it will also pump a large quantity of water in proportion to its size.

DOUBLE-ACTING PUMP.—Hiram C. Stouffer, New Lisbon, Ohio. With this pump a continuous stream of water is obtained, while its construction is designed to be simple and inexpensive. It has an upper or discharging cylinder, and a lower piston cylinder with an inlet at both ends and inwardly opening valve. A union plug is detachably secured in the upper end of the lower cylinder, in which is fitted a flap valve, closing when the piston is on its up stroke and opening as the piston is forced down.

AUTOMATIC BLOCK SIGNAL.—John D. Taylor, Chillicothe, Ohio. This signal has preferably four radial arms attached to an axle to be rotated by an electric motor, a magnetically operated clutch causing the motor to operate two signals, a relay with carbon contacts controlling the motor and magnets, while a lamp having lenses and mirrors is arranged to give two separate and distinct visual signals. This revoluble signal is arranged to eclipse the light beams in alternation, and to be more plainly visible and make a wider distinction between the indications of danger and safety than is ordinarily made, the signal being controlled by a strong and effective current.

THE PROPULSION OF VESSELS.—William H. Witte, Long Island City, N. Y. This invention provides a positively working, easily controlled apparatus, not liable to get out of order, for propelling vessels, by means of pistons, moving in open-ended pipes extending longitudinally beneath the vessel. Mechanism is provided for automatically raising the pistons from the pipes at one end of the stroke and inserting them in the pipes at the opposite end of the stroke, the impact of the pistons on the water and the jet or current issuing from the pipes both operating to propel the vessel.

MARINE VESSEL.—Sebastien Lacavaleric, Caracas, Venezuela. This vessel has conical bow and stern portions connected by a depressed keel, and between the bow and stern portions is suspended a main cylindrical body, incased by a revoluble screw extending its whole length. Access is had to the interior of the vessel through manholes, and the vessel is designed to attain an extraordinarily high rate of speed, to be propelled below the surface of the water if desired, and to be used advantageously as a torpedo boat.

Railway Appliances.

CAR COUPLING.—Victor Brett, Bangor, Me. This invention provides an improvement on a former patented invention of the same inventor, for a coupler of the class known as the double link and pin type. The drawhead is spring-supported, and has a slight sliding movement beneath the car, and it has pin openings over one of which is a casing in which is located a spring-controlled coupling pin adapted to drop at its free end through the casing slot, while a trip lever is adapted to elevate the pin and operate it during the coupling process, means being also provided for drawing the pin from the pin openings. The device is of durable construction, and with such a coupler the cars may be automatically coupled.

SAFETY CAR FENDER.—George Q. Seaman, Alexander Wilson, and William Jones, Brooklyn, N. Y. This fender comprises a longitudinally-yielding frame, with the inner end of which is connected a lever pivoted to the car frame and connected with the brakes, and also connected by a lateral arm with the grip. A person struck by the fender is received thereon with but slight shock, and the car is at the same time automatically stopped.

Mechanical.

SCREW SWAGING MACHINE.—Jules Le Blanc, Paris, France. This is a machine whereby pieces of metal are rolled between two segmental parts turning in opposite directions in such manner as to form screws, bolts, rods, mouldings, shafts, etc. Combined with two concentric segmental die holders mounted on parallel shafts journaled in stationary bearings held at an invariable distance from each other is a counterbalanced work holder held loosely on one of the shafts. The arrangement permits the iron scales to fall away, while allowing the tools to work equally on all parts to shape a piece of metal during a fraction of a turn of the machine.

TUBE CUTTER.—John F. Beck and Julius W. Kotkins, Grand Rapids, Mich. This cutter is guided and mounted to swing in a mandrel, on which is fulcrumed a lever engaging the cutter at its free end to impart a swinging motion to it to cut the tube. The device is composed of but few parts, will not get out of order easily, and operates rapidly to cut a tube without much exertion.

NUT LOCK.—Aaron C. Vaughan, Rockford, Ohio. This device consists of a divided spring ring having one of its ends extended past the other and projecting beyond the circle of the bolt to give a bearing for the wrench, while its other end is bent or curled inwardly from the circle of the bolt, this special construction of the divided spring ring enabling it to be turned to place by a wrench.

PACKING.—Richard J. McIlhenny, Wilmington, N. C. A self-adjusting metallic cup packing has been provided by this inventor, for use on any kind of device, and which is effective when acted upon by any pressure, from the smallest amount to as great a force as can be confined in any cylinder. It is perfectly steam, air, and water tight, and adapted for use on pistons, stuffing boxes, and other joints.

Agricultural.

PLANTER AND CULTIVATOR.—Henry Nehrmeyer, Reinhardt, Texas. The main supporting frame of this machine is adapted to be interchangeably connected with various implements for different kinds of work, such as planting and cultivating and stalk-cutting devices, and the machine is designed to plant or cultivate three, five, seven or more rows at one time with the aid of but one operator.

COTTON OR CORN PLANTER.—This is another invention of the same inventor, providing an inexpensive machine in which a series of planting devices is arranged and adapted to travel in parallel rows, automatically planting the seed without being guided by hand. The several planting devices are adjustably secured on the main frame to plant rows spaced apart the desired width, and each of the planters is capable of independent vertical movement.

STALK CUTTER.—A further patent granted the same inventor is for a machine more especially adapted to cut four rows of stalks at one operation, in an effective and economical manner. The machine is of simple and inexpensive construction, and the several cutter devices are adapted for independent vertical adjustment, or they may be elevated together, these parts being so arranged as to require the assistance of but one operator, who adjusts them from the driver's seat.

HARROW.—Hope H. Tigner, Stinson, Ga. This harrow has a solid corrugated back forming steps, with a row of blades upon each of the steps, the blades of one row being curved in an opposite direction to that of the blades in the row next to it, the blades thus being in serpentine order from front to rear. The implement is especially adapted for smoothing land, covering small grain, and pulverizing clods. It is very light, and weight may be placed on the back of the plate when necessary.

GRAIN EVENER FOR HARVESTERS.—Frank C. Almont, Sibley, Iowa. This is an attachment which may be placed upon the platform of any self-binder, to bring the straws of grain evenly to the entrance of the elevator, acting also as a packer or cleaner to dislodge fine grasses and rubbish liable to accumulate at the rear edge of the sickle. A separate vibrating evener bar is arranged parallel with and between the sickle and apron, the motion of the bar being controlled by guides attached to the front frame bar, while it also has a loose drag connection with the sickle.

Miscellaneous.

RECOIL OPERATED FIREARM.—Frank Wackermann, Pittsburg, Pa. This is a magazine gun, with the magazine beneath the firing barrel and having a spring-pressed follower, the breech block being held to slide in an extension of the firing barrel, while a loading lever beneath the breech block acts as a check on the cartridges in the magazine. A lock latch is adapted for engagement with the breech block, in which is contained a firing pin, and the trigger has actuating connection with the breech block, firing pin and loading lever. When the magazine is empty the cartridges may be placed directly in the firing barrel, thus making an effective single loader.

HEATER, COOLER AND VENTILATOR.—Emil F. Ruehr, Vienna, Austria. This invention provides a combination apparatus, more especially designed for use in dwellings and other buildings, to supply pure air, cooled or heated. It consists principally of a central boiler surrounded by water compartments and in communication therewith, while an air supply pipe discharges into the lower end of each of the compartments to force the air through the water to wash and purify it and change its temperature to that of the water.

AIR PUMP FOR FORCING BEER.—John L. Steitz, Chicago, Ill. An improved air compressor, simple and durable and very effective, has been devised by this inventor for automatically forcing beer from the keg to the faucet, the compressor being driven by water under pressure, supplied by connection with a pipe such as usually affords the water service. The air supplied is passed through an ice box, and when any beer is drawn the compressor is automatically and continuously operated to restore and keep up the pressure of cold air on the beer in the barrel by which the liquid is forced through the pipe to the bar.

HAME TUG.—James W. Rookwood, Jerico, Mo. This is a device adapted for either single or double harness, one which does not necessitate the puncturing of the tug, the trace being adjustable thereon without holes in the trace, and it may also be connected with and adjusted vertically on the back band of the harness, to suit horses of all sizes. It has an elongated body with transverse slot, a leaf hinged to the body having a tongue projecting into the slot, while a trace head is secured to the body in front of the slot, whereby the leaf will be held closed by the trace.

WINDOW OR DOOR FRAME ATTACHMENT.—John D. Johnston, Newport, R. I. This invention relates to means for securing storm sashes, screens and outside blinds to window and door frames without marring the stop beads or strips, the fastenings being conveniently applied. A tongue in the form of a flat plate is pivoted in a casing having a slotted face plate, and the attachment is fitted in mortises in the outside stop bead or casing of the frame at each side, the face plate and tongue normally lying flush with the tongue. To secure a storm sash or screen in position, the tongue is swung out and secured to the sash or screen frame by means of a screw, for which purpose a suitable aperture is provided in the tongue.

CIGARETTE MACHINE.—Jose R. y Hernandez, Havana, Cuba. This machine has two parallel rollers, one stationary and the other displaceable, a pliable apron secured to the rollers normally hanging between them, and on which is placed the cigarette wrapper and fillings. There are elastic connections for drawing the movable roller toward the stationary roller and means for rotating the latter. The machine can be used for making cigarettes of different diameters and the pedal is depressed but once at each operation of rotating the fillings and wrappers.

UMBRELLA DRIP CUP.—Timothy J. Golden, Jacksonville, Fla. This is a device which, when not in use, may be attached to an umbrella and folded up in its body portion, while it may be quickly applied to and locked upon the ferrule end of the staff. The device consists of a cup with a hollow pliable body and grafed opening at the top to receive the staff, while keepers receive the locking devices and a rigid plate or disk constitutes the central bottom portion.

MUSICAL INSTRUMENT.—William E. Bent, No. 144 Van Buren Street, room 21, Chicago, Ill. This instrument, styled by the inventor the Egyptian monochord, is of the banjo type, and has but a single string, adapted to be played upon with a bow. The bridge rests upon a tortoise shell plate and the latter upon a metal plate, ordinarily of aluminum, and which rests directly upon the skin head, the employment of the shell and metal plates between the bridge and head being designed to soften and modify while augmenting the power of vibration of the string. The inventor has attained great facility of performance on this new instrument, imitating successfully therewith a variety of other stringed instruments.

TIME ALARM BED.—George Q. Seaman, Brooklyn, N. Y. This is an improvement on a formerly patented invention of the same inventor, for a bed of simple and durable construction, and so arranged as to cause the occupant to roll out of bed at a predetermined time. A pivoted bed bottom is connected at its free end by ropes with a drum removably journaled in the ends of the bed, the drum forming a side for the bed and being arranged to drop out of its supports in the head and foot at the time for which the alarm is set.

QUILTING FRAME.—John P. Banker, Honey Grove, Texas. This invention relates to quilting frames in which a track is provided from which the quilting frame proper is suspended, and means provided for tilting the track to facilitate running the frame longitudinally in both directions, and the improvements include a novel means of supporting and tilting the track.

WASHING MACHINE.—Thomas McCrossan, Winnipeg, Canada. In this machine a cylinder containing the clothes and water revolves upon hollow axes or tubes, and the clothes are raised out of the water by shelves until they fall by gravitation and the water is poured upon them, corrugations in the interior of the cylinder causing the clothes to continually revolve upon themselves, thus effecting a thorough cleansing.

KITCHEN CABINET BIN.—Frank E. P'Pool, Brandon, Texas. This device, styled by its inventor the "Lone Star," cabinet bin, is designed to form an ornamental and handy piece of kitchen furniture, having compartments for flour and meal and sieves so arranged that sifted flour will be supplied, or a mixture of sifted flour and meal, in such proportions as may be desired. The flour and meal are sifted without handling. The bin also has compartments to hold rolling pin, bread pan, cake moulds, etc., with shelves for spices and seasoning, egg beater, nutmeg grater and a variety of other articles.

PATTERN FOR DRAFTING GARMENTS.—Della Ryan, Owosso, Mich. This is an adjustable pattern in which the front piece has at its front edge an adjustable chest piece composed of sections pivotally connected together at their meeting ends, and connected pivotally with the body of the garment at their opposite ends. With this pattern a convenient enlargement or reduction may be effected in the direction of all measures. The other portions of the pattern, as the under arm piece, the side body, the back piece, the sleeve piece, the skirt, etc., are also formed in sections, with sliding and adjustable joints or connections, so that the pattern may be adjusted in all directions to suit the shape desired.

DESIGN FOR ORNAMENTAL METALLIC WRAPPER.—Leopold Kahn, New York City. The body of this design comprises a central circular figure and radially extending arms of open work simulating a lace-like structure.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

SANDOW ON PHYSICAL TRAINING. Edited by G. Mercer Adam. Profusely illustrated from Life Studies. New York: J. Selwin Tait & Sons. Pp. xvi, 244. Price $3.50.

Eugene Sandow is conceded to be the strongest man, physically, and the most symmetrical, in the world, and this book gives, on his own authority, his simple method of physical education and his views on the physiology of gymnastics, the function of the muscles, etc., together with a comprehensive biographical sketch, in which is noted many of his marvelous feats of strength. The book is also one of the most sumptuous works ever published on the subject of athletics, being printed on extra heavy paper, with wide margins, embellished with marginal illustrations; but its greatest value lies in the fact that its subject matter is presented in a way likely to be of solid value to every man and woman, and every young person of either sex, who comes to its perusal with any intelligence whatever. His system is simplicity itself; it calls, not for abstinence, but rather for temperance in everything. The basis of it all is *work*; never too much work for the whole body, or any set of muscles, but the work must not be fitful or intermittent; it must be steadily continued, and always up to a nearly full quantity of work before resting. Sandow is now 27 years old, but at the age of 10 he was by no means a strong boy, although healthy and well formed. Among the chapters of especial value are those on hygienic and medical gymnastics, exercise and the bodily functions, the chief muscles, where they are situated, and what they do, with full pictorial explanation, as is also the case with the concluding chapter on the most profitable exercises.

GOODWIN'S IMPROVED BOOKKEEPING AND BUSINESS MANUAL. By J. H. Goodwin, author of "Goodwin's Improved Bill Book" and "Goodwin's Practical Instruction for Business Men." Sixteenth edition. New York City: Published by the author, 1215 Broadway. Price $3.

This is one of the most comprehensive and at the same time most distinctively analytical of any of the treatises on bookkeeping or business men's manuals that have yet appeared. It shows how to keep books in the simplest way, by those who do not make a profession of such work, and it also shows a thousand different phases of scientific bookkeeping, with explanations of technical details familiar only to experts in many lines of business. The head bookkeepers of many of our largest merchants are credited with having furnished the author special points in regard to their methods. The book is handsomely and solidly got up, has a thoroughly good index, so that it is always easy to find information on a mooted point, and is well adapted to fill the wants of a beginner or to aid in enlarging and perfecting the system and methods of the most accomplished expert accountant.

THE STUDY OF THE BIOLOGY OF FERNS BY THE COLLODION METHOD. By George F. Atkinson. New York and London: Macmillan & Co. 1894. Pp. xii, 134. Price $2.

This book relates to the preparation of ferns and describes the formation of their different parts, giving views of cross sections and other reproductions. The preparation of specimens and their production by the collodion method is the characteristic feature, and a short bibliography of the subject is given.

SCIENTIFIC AMERICAN

BUILDING EDITION.

MARCH, 1894.—(No. 101.)

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2. Plate in colors showing an attrative residence at Providence, R. I. Perspective view and floor plans. Estimated cost $5,500 complete. An excellent design.
3. A dwelling recently erected at New Haven, Conn. Perspective view and floor plans. A unique design.
4. A beautiful residence at Edgewater, Chicago, Ill., recently erected for Clarence M. Stiles Esq. Perspective and floor plans.
5. Engravings and floor plans of a suburban residence erected at Belle Haven, Conn. An attractive design. Messrs. Boring & Tilton, architects, New York.
6. A suburban dwelling recently erected at Elizabeth, N. J., at a cost of $4,200. Floor plans and perspective elevation. Messrs. Charlock & Howard, architects.
7. A Queen Anne cottage at Ardmore, Pa., recently completed for Mr. Frank A. Apple. Floor plans and perspective elevation. An artistic design. Mr. J. M. Harlan, architect, Ardmore, Pa.
8. Two cottages at West Haven, Conn., erected at a cost of $2,050 and $2,200 each. Floor plans and perspective elevations. Mr. Rollin L. Hine, West Haven, Conn., architect. Instructive designs.
9. A Swiss cottage at Glenbrook, Conn. Perspective view and floor plans. Mr. D. W. King, New York, architect. An attractive design.
10. A Queen Anne cottage at Wyncote, Pa., erected at a cost of $4,900. Mr. Angus S. Wade, architect, Philadelphia, Pa. An excellent design.
11. An attractive residence at Hartford, Conn. Floor plans and perspective elevation.
12. Sketches of John Milton's cottage at Chalfont St. Giles, and interior view.
13. Page engraving, showing the west (main) facade of the new German Reichstag building, Berlin. Plans drawn by Paul Wallot.
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Microbe Killer Water Filter, McConnell Filter Co., Buffalo, N. Y.

Pipe frame truck baskets, steel and wooden trucks, etc. L. M. Moore, Rochester, N. Y. See page 157.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Wanted—A first class patented lock for folding paper boxes. Address Boxes, care of Scientific American.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5907) E. C. L. writes: I have two ⅛ horse power C and C motors marked 6½ volts, 20 amperes, also 10 cells storage battery, said to represent 200 ampere hours. Is it practical to connect the two motors on same shaft, and if so, would I get ¼ horse power, and if so, how long would the motors run with full load? A. Put your cells three in series and three in parallel, leaving out the odd cell. You can put both motors on the same shaft. The cells will run it at 20 amperes in each motor for 15 hours.

(5908) W. C. F. writes: I have tried repeatedly to light natural gas with an automatic fixture, but cannot do it. I have a good 10 inch spark coil and have used as high as 10 Leclanche cells, and fail to ignite the gas, although the fixture throws a good spark. What is the trouble? A. The trouble we presume is in the gas, which is probably of a low grade and hard to ignite with a simple spark.

(5909) H. W. P. asks: To what depth can a diver, equipped with most improved dress, descend and work in the ocean? A. 90 to 100 feet is the deepest that divers can go with safety. 2. What is the pressure at following depths in ocean—100, 200, 300, 400, 500 feet per square inch? A. The pressure is 0·433 of a pound per square inch for each foot of descent; 100 feet is 43½ pounds, 500 feet is 216 pounds. 3. Who is the best diver at present day? A. There are many divers along our seaboard that can work at the greatest safe depths. 4. What are the main obstacles to a diver descending 500 feet? A. There is no obstacle in going down 500 feet. The trouble is in getting back alive. The armor and hose would collapse.

(5910) D. S. D. asks: 1. Where can I find directions for making a Wimshurst electric machine? A. We refer you to our SUPPLEMENT, Nos. 548, 647, 914, 919, 948. 2. Does the permanent magnet in an electro-magnetic machine lose any of its power by use? A. It is apt to gradually deteriorate. 3. Are there magnetic rays in the solar spectrum? If so, in what color, and what intensity are they? A. No.

(5911) K. says: What is the first book necessary for one to get, wishing to study pharmacy? A. We recommend the United States Dispensatory for a single work on the subject of pharmacy. Price $8. For a practical work on the practice of pharmacy get Remington's "Pharmacy," which we mail for $6. Send for our new book catalogue, which describes many works on pharmacy, mailed free on application.

(5912) H. W. H. writes: In front of my bath house on the shores of Narragansett Bay there is growing in the water a patch of that sea weed commonly known as eel grass (*Zostera marina*), which is very annoying, not to say dangerous. It is submerged, though not deeply, at low tide. Can you suggest any method of exterminating or removing temporarily this troublesome weed? A. Eel grass is generally found on mud flats or where there is a loam bottom, shallow at low tide. Scraping the grass and roots ashore and placing in the compost heap is probably the cheapest way of removing it within a hundred feet from the shore. This can be done in many places by a drag scraper and horses hitched to a tow line running through a snatch block anchored on the beach. Otherwise dredging is the only recourse. There is no way of killing the grass in an open tideway.

(5913) T. H. says: A party here about getting a launch built to order proposes to run two 6 inch tubes through from bow to stern half way between the keel and side of hull. His idea is that the water passing through the tubes will diminish the resistance caused by displacement of water at the bow. A. The tubes will not give a free run of water from bow to stern. Their friction surface is larger in proportion to the area of water flowing through them than for an outside surface. The weight of the tubes and water adds to the draught of the boat and thus compensates for any relief to outside friction; besides, they will be an encumbrance and a nuisance to the occupants.

(5914) L. H. C. asks: When was the steam whistle patented or when first used? A. The steam whistle was invented in 1826 by Adrian Stephens in England. It was at first used on safety valves as a louder signal, when blowing off. They soon after came into general use for other purposes. There are many American patents for the various forms in which it has been constructed during the past 50 years.

(5915) M. McM. writes: W. S. says the pressure on the slide valve of an engine is equal to the given pressure per square inch on the entire valve. I claim the pressure is equal to the given pressure per inch on the area of the port that is covered less the back pressure from exhaust. A. The pressure on the valve is equal to the steam chest pressure on the whole area of the exhaust cavity, including the exhaust lap, if any, less the back pressure of the exhaust.

(5916) A. E. B. asks for the way to make an Æolian harp. A. Simply stretch catgut strings across a board with battens at each end to serve as bridges. This may be elaborated to any desired extent. See our SUPPLEMENT, No. 483.

(5917) N. J. M. writes: Suppose a 1 inch diameter piston making a 1 inch stroke, lifting 1½ pounds (lowest pressure) 40 strokes per minute. If the power be supplied by compressed air pumped into a reservoir, by an ordinarily strong person, with as large a pump as would be most practical to stand on the floor, using both hands, how much time would be used to supply enough compressed air to keep the machine in motion two hours? About how large a pump compressor would be most practical? Is a leather expansion piston, such as is used in bicycle tire inflating pumps, a good form for 1 inch diameter piston mentioned? Would good tin be strong enough for reservoir mentioned? A. You will require a double acting air pump 2 inches diameter, 5 inches stroke, with crank and balance wheel, to make the work easy, with which a man can compress enough air in ten minutes to run the engine two hours. Any compression pump of the proper size as above will do the work. The leather expansion piston is excellent. Tin in small cylinders is strong enough for the air tank and should be capable of 10 pounds pressure per square inch.

(5918) W. A. W. writes: In your issue of the SCIENTIFIC AMERICAN of February 24, in your answer to C. F. M. (5817), who asks how to make a spark coil, you say: "Make a bundle of iron wire ¼ inch thick and 8 inches long. Wind it with No. 22 wire to a total diameter of 2 inches." Does it make any difference what size iron wire you use? Do you wind the No. 22 wire directly on to the iron wire? What kind of a No. 22 wire do you use, *i. e.*, is it a single covered or insulated office wire? Is No. 22 any better than No. 14? A. Iron wire not coarser than No. 15 is to be recommended. Common stove pipe wire is as good as any. Wind directly on the iron wire, using single or, better, double covered magnet wire. No. 22 is better than No. 14.

(5919) K. G. K. asks (1) for the process of testing gas meters, such as is used by most large companies. A. A known quantity of gas from a graduated gas holder is passed through to determine its accuracy. Gas is also passed through very slowly, to test whether it passes any without registering it. 2. The internal working of same. A. It works like a steam engine. Bellows represent the piston and cylinder, and slide valves distribute the flow of gas.

(5920) H. B. asks: How do you connect two Bell telephone receivers so as to use one as a transmitter and one as a receiver? A. Connect them in parallel.

(5921) E. H. B. asks: 1. I have a quantity of metallic gold which is adulterated with some foreign substance (presumably arsenic) which renders it brittle and immalleable. What is the best simple method of freeing the metal from its impurities? A. Melt with borax and sodium nitrate. 2. In a magic lantern or stereopticon should the convex surfaces of the condensers be mounted any exact distance apart? A. No; theoretically they may be any distance from each other.

(5922) H. H. asks: 1. Can a 16 foot boat be run by the simple electric motor, 641? A. Not well; we do not advise it. 2. If so, can it be run by storage batteries? A. Storage batteries are the only available ones for the purpose. 3. Can the storage batteries be made by an amateur? A. We do not advise this either. 4. Can they be charged by gravity batteries? A. Very slowly and unsatisfactorily. 5. If so, how long will it take? A. It depends on the number of cells. 6. How long will the storage batteries run the motor? A. It depends on their number and size. 7. Why can not pottery jars be used instead of glass for gravity batteries? A. They do not permit the solution to be observed. 8. How fast will the motor run the boat? A. Two or three miles an hour. 9. How should the motor be wound to run from a 52 volt incandescent circuit? A. Wind with No. 25 on field and No. 30 on armature. 10. Can the simple electric motor be made and sold without infringing any patent? A. Yes.

(5923) A. A. H. asks: 1. How is a dry battery recuperated? A. By passing a reverse current a dry battery may be to some extent recuperated. 2. What is meant by the depolarization of a battery? A. The removal of hydrogen from the carbon plate is generally the action. 3. Is there any gunpowder which makes no noise at the time of explosion? A. No. 4. What parts of sulphuric acid, nitric acid, and glycerine are mixed to make the most explosive nitro-glycerine? A. A mixture of strong nitric and sulphuric acids in considerable excess is used. 5. Where can I get some antimony? At what temperature does it melt? A. Address Queen & Co., Philadelphia, Pa. It melts just below a red heat.

(5924) W. W. asks for a formula for calculating the thickness required for the ends of a heater say 30 inches diameter to carry 100 pounds pressure, of cast iron; and likewise for wrought iron, without stays. I have tried to find a rule for this, but have been unable to get one. A. There is no fixed formula for unbraced heads of tanks or boilers. The form of the head, whether flat or arched, and the method of fastening, is a general index in regard to the thickness of plates for heads. A head of wrought iron or steel, if raised or bumped and flanged for riveting to the shell, need be no thicker than the shell. If the head is to be flat and bolted to a flange on the shell, it should be 50 per cent thicker than the shell up to 36 inches diameter, and above 75 per cent thicker. Cast iron heads bolted to flanges on shell should be dished, and three times the thickness of the shell for sizes of 30 inches and under, four times the thickness up to 48 inches.

(5925) L. M. asks: How can a canoe boat be made watertight when some of the boards have cracked? The cracks? are not large enough to calk, but simply large enough to let it fill with water. A. When the wood is thoroughly dry try if varnish will not fill the cracks. If this is not enough, then putty them. The varnish will give the putty a good hold. You may mix a little varnish and red lead with the putty and color with yellow ocher or umber, as may be necessary, if the canoe is of natural color. As a temporary cure for a leak, soap is sometimes used.

(5926) G. W. G. asks the origin of the term "journal," as applied to the bearing of a shaft; also why it is called a journal. A. The term "journal" in mechanics, and relating to the part of a shaft revolving in a bearing or support, is also used in the French, Spanish, Portuguese, and Italian languages with the same meaning. It is derived from the Latin "diurnalis," daily, and "diurnis," belonging to the day. It is very old, and may have been applied from the motion of a journal resembling the idea of the revolution of the earth in a day.

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March 20, 1894,

AND EACH BEARING THAT DATE.

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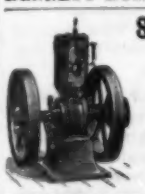
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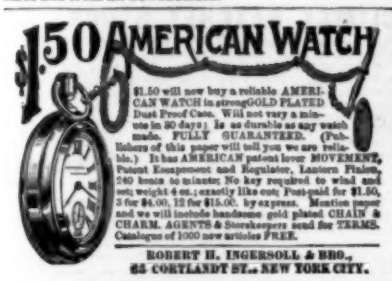

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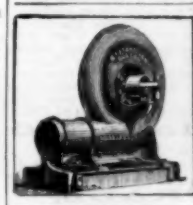

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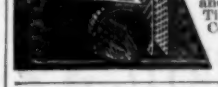

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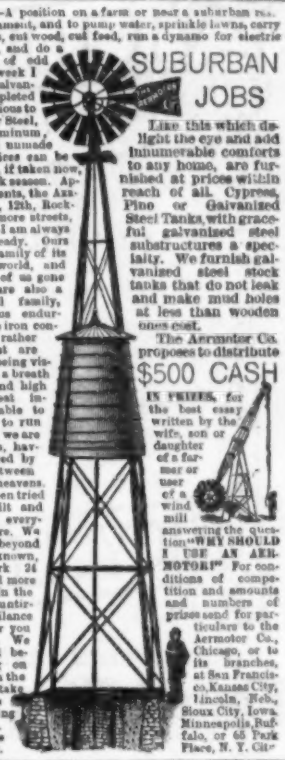

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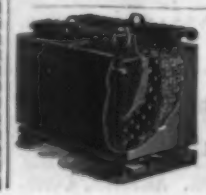

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